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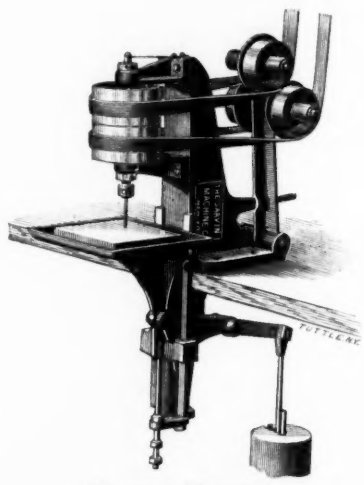
## Improved Machine Tools.

We illustrate herewith some machine tools recently brought out by The Garvin Machine Co., of New York City.

The first of these is a tapping machine for light work, and which is intended to be fastened to the bench. The spindle, which is vertical, is counterbalanced by the flat spring shown at the top, and has keyed to it, at about the middle of its length, a friction disk, which is beveled each way from the center, in such a way as to engage with either of two friction cups which are attached to the driving pulleys through which the spindle passes. A continuous or endless belt is used, which passes around these pulleys and over idlers in such a manner as to drive the pulleys in opposite directions, and the substitution of the double friction disk for the interlocking clutch usually employed enables the motion of the spindle to be reversed by a very slight vertical movement of the spindle—as a matter of fact but little over $\frac{1}{32}$ inch.

The arm to which the idler pulleys are attached is pivoted at the bottom, and its upper end can be thrown in or out by the screw shown above the pivot to regulate the belt tension.



TAPPING MACHINE.

The table upon which the work is laid is counterbalanced by a weight and moved by a foot treadle (not shown), leaving the hands free to handle and manage the work. Adjustable stops are provided for limiting the movement of the table in either direction.

Two sizes are built, the smallest for tapping holes of all sizes up to $\frac{1}{8}''$, the larger up to $\frac{1}{4}''$.

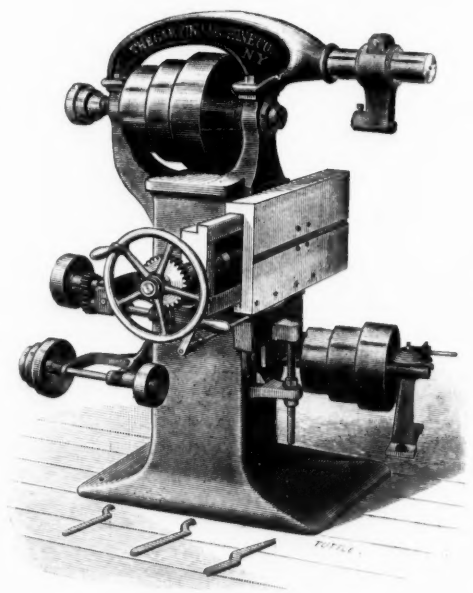
The screw machine shown is intended for work of a general character, and has all the features usually found on such machines, including a clamping device for the turret, and back gears. These features, together with its general solidity, adapt it to all heavy or hard work within its nominal capacity.

The turret has the usual automatic revolving motion, and the stop-pin is of hardened and ground steel working in hardened and ground steel bushings in both the slide and turret. This not only makes the mechanism very durable, but makes it easy to remove the effects of wear in these parts, as they are all plain cylindrical pieces, which can easily be ground and fitted.

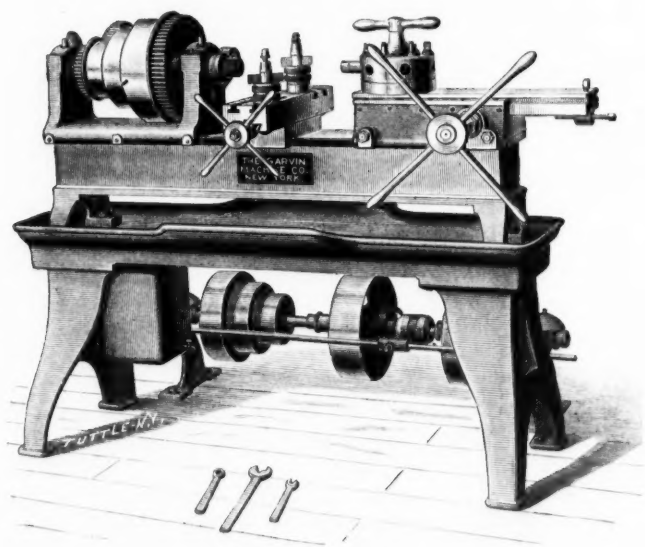
The milling machine is intended especially for manufacturing operations, the first one being built for a small-arms factory, since when others have been built for various purposes. The fixture for holding the work is fastened to the side platen, the face of which is out from the column a sufficient distance to clear the stop screw and lugs below, thus admitting of the doing of work on the end of long pieces.

Automatic feed is provided in the manner indicated by the cut, and there is also an adjustable automatic stop-motion for the feed.

Countershafts, wrenches, etc., accompany all the machines.



MILLING MACHINE.



SCREW MACHINE.

## Some Talk About Steel.

BY S. W. GOODYEAR.

First, about water annealing. It is believed by many mechanics that steel is rendered as soft as or even softer than by the regular slow-cooling process if it be heated to the annealing heat, and permitted to cool down to a just right condition, and then suddenly cooled off by immersion. This is called "cold-water annealing." It is generally believed that success depends upon the heat at which immersion takes place, and much time has been spent by teachers of the art in explaining to listeners "how to judge of the heat at which to dip a piece of steel so that it shall be water-annealed to be softer than by any other method." "Just when the piece ceases to show red in the dark"; "hot enough to ignite and cause to sparkle fine charcoal dust if sprinkled upon it." There are methods of arriving at the heat to produce these wonderful results besides these, but these are, perhaps, most common and appear most simple; still there are difficulties attending them both. "Red in the dark." How dark? How red? etc., etc. "Ignites fine charcoal dust." Yes, it will do that when too hot. Now, how to draw the line exactly? It must sparkle, but at just the last degree of heat which would ignite the charcoal dust. Of course you know all about this. In common with the writer, and other old-time mechanics, you have stood cross-legged, and shifted from one foot to the other as you held the piece of to be "cold-water annealed" steel in a dark place, in the charcoal barrel, in a hole in the brickwork of the forge, over back of the big leathern bellows, etc., etc., until you ached in every joint, and eyes were strained with watching the heat, and you *have* missed it; "did not hit the heat just right." No, you did not, provided you cooled the steel from any such degree of heat as recommended. The real fact is, and can be demonstrated at any time, that the alleged water-annealing process is a myth. What do I mean? Would I contradict the assertions of the thousands who "know positively that the softest steel they ever worked was annealed in that way"? I simply mean that, however much any piece of steel may have been softened, annealed, from the condition in which it was before the process by this alleged "water-annealing," it would have been made softer still by being permitted to cool entirely in the slowest manner practicable, instead of by dipping. In other words, the annealing process is arrested at the stage at which immersion takes place.

That now and then a piece of steel should work exceptionally well from water-annealing is no more strange than that exceptional bars of steel direct from the rolls or hammer of the manufacturer are found to work as soft as though annealed, or that other bars seem to resist all efforts to anneal them.

What is annealing? Is it not accomplished by heating to proper heat, and permitting to cool slowly? What is hardening? Heating to proper heat, and cooling suddenly, is it not? They why should the very thing which is admitted to be the hardening agent get credit for annealing?

How hot should steel be for annealing? About the same as would be a suitable heat for hardening the same steel. Cooled off, how, from that heat? Slowly. No dissent to this, is there? But what legions of definitions has this word "slowly," if judged by the practice of steel workers!

Packed in boxes with charcoal, or other similar material in which the steel is heated, and when judged to be hot enough the draught or blast shut off from the furnace, and all cool down together, taking days; and from this the range of practice reaches through heating without packing and burying in lime, sawdust, charcoal, ashes, hot embers, etc., etc. Throwing upon the ground, cold or hot, wet or dry, laying upon a cold anvil, or sow, etc., etc., putting into a box of ashes kept for the purpose, when they are so cold as to actually harden corners and thin sections. "Don't?" Perhaps readers of the AMERICAN MACHINIST don't, but there are those who do.

Said a smith to the writer, when I called his attention to the heat at which I purposed to anneal a piece which had resisted all efforts to plane it, "*That won't anneal at that heat;* I've tried it three times; I had it hotter than that the first time, and I heated hotter each time; that heat will do nothing to it." It was buried up, however, in hot embers taken from the forge, and when cooled down from a *low red heat, not bright red*, it was planed without the least difficulty. Where is the point? Let's say points. This piece of steel was in some of its parts quite thin. The ashes in that annealing box outside the smith's door were cold. The steel might almost as well have been plunged in a pail of water, so far as the thin parts were concerned. "But I took hot embers from the forge fire in which to bury the piece. Who wants to be put to all that trouble? Steel is wanted which will anneal without any such nonsense." There, there; just hold on a minute. The steel was wanted to be soft, was it not? Three attempts to make it so by that too commonly believed to be easy method which involves no care, no thought, only to heat and bury in ashes, had resulted in failure. The first attempt with the hot embers had not only proven successful, but had proven that the three former *attempts* ought never to have been made. The thing which needed to be done should have been done the first time trying, by being willing to "take the pains," "be put to the trouble," which a little reasoning must have shown to be necessary.

It is probably the fact that on no other point connected with the use of steel is there so great diversity of opinion as upon that of what constitutes proper annealing, or rather upon how soft it is necessary, and at the same time best to have steel for working. Something else than the satisfaction of having steel work soft must be considered. The ultimate value of the pieces under treatment is of much the greatest importance. Many pieces of steel which might have been worked as they were by the exercise of a little added patience, the use of a little better tools, a little more time spent, have been practically ruined by re-annealing, at a blistering heat, because alleged to be "so hard that a tool would not touch them."

Said a proprietor, a practical die sinker, "I had at one time a pair of dies to be put under trial which my die sinker reported to

be so hard as to make it impossible to sink them. Feeling quite anxious to have the dies tested, and fearing that if re-annealed they would be injured to some extent, I took the chisel and hammer from the hands of the man who declared that no chisel would stand to cut them, and soon convinced myself and demonstrated to him that the dies could be sunk, and said to him that the fact of their being so much harder to cut than what had been used encouraged me to expect better service when hardened and put in use. With much growling, under protest, my die sinker sunk and hardened the dies. They stood under the blows of the ponderous drop to double the service of the maximum production of dies formerly used, and to do three times the average." "Because they were hard to sink?" "Because sunken when not well annealed?" No, not that; but because that particular steel in the ordinary way of annealing would not become as soft as the other; and to be at its best when hardened, and put in use, it must not be made as soft by some special annealing. Here was the indication at the very beginning to the thoughtful proprietor, that, when finished and hardened, there would be just what he had been looking for, *i. e.*, the combination of qualities for hardening hard and deep, to withstand the tendency to sink, with extreme tenacity to resist the tendency to chip out by transverse strain. It was the simple question of getting the right things for the use, and then accepting the situation and working it for what it was—a hard steel. Steels vary in hardness in the bar, in the annealed condition, and in the hardened condition in proportion to variations of temper. Wise selection of steels best adapted to each particular use, and then treating each for what it is, instead of trying to make all work alike soft, would work wonders in many shops where the main reason for using certain steels is that they "work so nice," "always turn, and cut, just as soft as iron. Why, you can cut them with your knife almost as easy as you could a piece of lead."

What a long letter about so small a matter! Yes, but there is more to be said; this is only a fraction.

## Core Making.

BY S. BOLLAND.

SECOND PAPER.

So far I have spoken of cores made with rods; but it is not always easy to obtain them, and something must be contrived in cast-iron, especially when the cores come larger than the ones I have been describing. My principal object in being so particular in these examples is to show how a makeshift may be made to answer, as the principles laid down will answer for much larger cores than the ones described, and are applicable to cores of different shapes. We will now consider cores of larger dimensions, and show the best methods of making irons for them.

Let the core to be made be 10 feet long, 2 feet wide and 1 foot 6″ deep, and when cast surrounded with iron; in this case we want a sound core with as little core iron as possible, as it has to be broken up before it can be withdrawn. What we lack in strength of core iron must be remedied by the number of places we lift the core by. Fig. 4 (Dec. 12th), will explain the kind of iron to be made in this emergency. This iron can be easily stamped or cut out in a soft bed, staples being pushed down the required depth, and the prickers put in to suit the kind of core it is for. Should there be any body of sand to carry below the iron, rods may be cast in to answer.

But should the ends of such a core come through the mould, a much different arrangement can be made. The core we considered last would require anchors under and over to keep it in place, but this one will allow of a strong beam or girder for main iron, and all we need to do is to tie the sand to it, which is done as shown in Fig. 5, which gives a view of rings around the main iron, with vent holes on each side; also the hole in bar for lifting core. This plan admits of almost universal application where there is much heavy work made. Fig. 6 shows the method as applied to half core for water cylinder 3 feet diameter. Another advantage in this method is that the bar and most of the rings can be saved for future use.

PIPE CORES.

Pipe cores are often a great trouble, when, if correct methods were adopted for their production, everything would be correct, and all annoyance cease as if by magic. The common and sometimes expensive method of using a half box fails very often—through carelessness or ignorance—to give a good round core, and I have frequently seen one or both halves fall apart in jointing, when, if a little judgment had been exercised by the coremaker, there needed to have been no trouble.

Figs. 7 and 8 show sections of half core with rods bent to suit the curve, these serving the purpose of clamps to keep the sand from spreading away from the main irons, which are shown.

The two methods of jointing are here seen. The plan of dry jointing is much quicker than the other, if the matter of a little fin is of no consequence.

By adopting this principle of making them, pipe cores up to 12″ may be made very readily, and even larger ones at a pinch. I have also shown how hooks may be applied for handling. It is better, in the case of elbows and bends, to put two main irons of medium strength, rather than one strong enough, as they can be more easily drawn out. No. 5 core mixture is to be used in these cores.

Larger pipe cores require different treatment, and as it is seldom that boxes are made for them, I will now show the way to make a 24″ diameter core in halves.

We will suppose the pipe to be in the form of Fig. 9. A template or pattern must be made 1″ thick, as much wider than the core as will allow of the sweep, shown at Fig. 13, to run on the edge with about 1″ of bearing. Let the template be from 6″ to 9″ longer than the casting at all the ends, this extra length being required for bearing or print. From this pattern or template you make—on a level bed—a right and left-hand plate from ¾″ to 1″ thick, according to strength required.

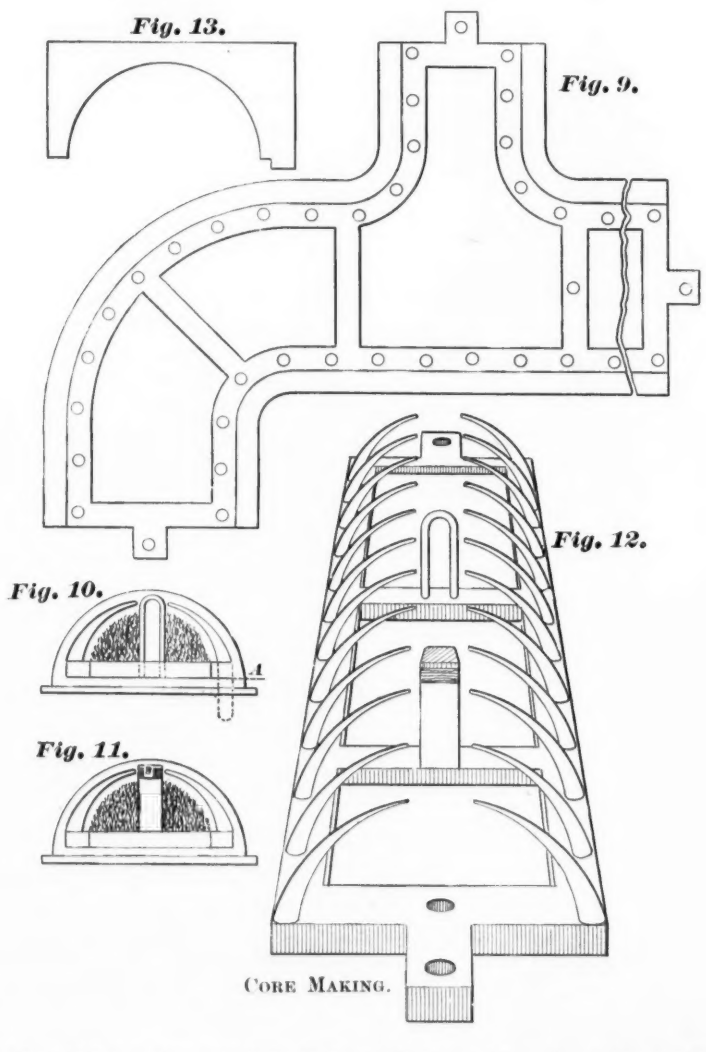
After which, prepare another level bed on which to make the irons. (I have shown in Fig. 12 a section, in perspective, of the kind of core iron you are to make.) Let your bed be well dug up, sufficiently deep to admit of the pricker pattern being pushed down to the required depth and direction. After your bed is scraped off, lay your template on, and mark it all around, right and left. From these lines as a guide you must trace out the shape of your iron, setting in from the outside, as far as will leave it clear of the core about 1½″. After cutting out or stamping down the sand to the right depth and width —which in the case of a 24″ core would be about 2″ deep and 3″ wide—you connect the frame by cross-bars, as shown at Fig. 9, at such parts as will be required for lifting, anchoring, or bolting together, if it should be necessary to do so. Fig. 12 shows staple for lifting, stud for anchor, and hole for bolt. You will require a curved pricker pattern made of iron, tapered as shown, one pattern serving for several sizes of cores. It is well to have the pricker pattern extend some distance beyond the distance it is to be pushed into the sand, the straight end answering for a handle, as shown at Fig. 10.

To obtain some idea of the direction to push the pricker down, draw elevation of core and iron as shown at Fig. 10, allowing for sand under the core iron. Place your pricker pattern on the sketch, and mark the depth and angle as seen.

There may be some little difficulty in keeping the pricker at the right angle at first, but a little practice will enable you to bring out your iron a perfect fit every time. I have no hesitation in saying that this makes the best and cheapest iron that can be made, as it can be applied to pipes of all kinds and sizes with absolute safety.

Your plates and irons being cast and cleaned, see that the edge where the sweep will run is smooth; throw on your parting sand and bed your iron on a thin layer of core sand. By referring to Figs. 10 and 11 you will see that cinders fill up the core to within a short distance of the prickers; let the cinders be well rammed down, and then ram on the sand. In large cores considerable old or floor sand may be used under the prickers, but it is well to let the core sand take good hold of them.

Should some of the prickers be too far away from the face of core, a few spike nails driven in will serve to make up the deficiency.




CORE MAKING.

Should anchors be required in the core, Fig. 11 shows how to put in the stud; let your packing rest on the cross-bar only high enough to admit of a piece of pine wood say 4″ square, on which must rest a piece of wrought-iron 3″ square, ⅛″ thick, the whole to stand ½″ below the top of core.

I do this to save the trouble of knocking out the studs, which must be done to save the casting, when anchor, stud and core iron are all touching. The plan suggested is simple; by the time that the thin plate at top has become hot enough to burn the wood, the iron is set, and all danger over. Of course the wood burns away and frees the stud. I have seen many castings break on account of there being no provision made for the shrinkage, or not being able to get at the stud quick enough. By careful survey of the figures given, you will see at a glance all that I am desirous of explaining. There will often be places where the sweep will not work, but by making a clean finish up to where it will reach on the plain, the rest will be easily overcome by the careful use of eye and hand.

There are constant demands on the ingenuity of the moulder or core maker to save cost of core-box, such as cores, where an ordinary sweep, as at Fig. 13, is of no use. For instance, a taper core is needed, for which there is no core-box. Fig. 14 shows a method of making such a core. A half-circle for each end, the diameter required —secured to straight-edges the length of core—serves as guide on which to work the strickle.

When proper attention is paid to the making of this kind of core according to instructions given, a very good core can be made in this manner.

It will be seen also that any departure from a plain core can be easily overcome by making the strickle to form the shape desired. Where small necks come—as they often do—a piece can be inserted in the frame, over which the strickle can pass as shown at *C*, Fig. 14.

This is done because of the difficulty of dragging the strickle through such a body of sand, leaving the core rough and out of shape.

It must also be observed that in making this core—should the neck be very small, and there be no suitable iron to make it with —that the ordinary straight iron in the length will be of no use, on account of being so far removed from the center of the core by the intervention of the neck. Figs. 15 and 16 will show how to act in such a case. It will be well to master the principles involved in this, as well as other problems suggested; for rest assurred that, if your work does not turn out correct, it is because you are ignorant of the way it should be done; and just as soon as you begin to ask yourself: "Why is this?" and determine to master first principles in your business, just so soon will your work become attractive, and be a pleasure rather than a burden.

A thorough workman knows from the beginning what the end will be, and leaves nothing to chance.

Sometimes a round core is wanted, some out of the way in size, for which there is no box. Let it be 18″x15″ deep. Should there be a pulley pattern, or ring, or coupling box, the size of core required, place the same on a true plate; set flask or flasks with room to ram sand in hard to the required depth; draw your pattern, and by a little care you may ram up a good core in the mould. After carefully digging away the sand from around the top edge, you may remove flasks, clean off and finish (see Fig. 17). Should there be nothing from which you can make a core this way, and there should be a gig or cross, and small spindle handy, run up a course of bricks, and sweep out with mud to size. When the core is rammed, pull the outside off carefully, and you have a good core. This plan works well, and saves considerable in pattern making, where but one is wanted from a job. Should the core be very large, and you have a lifting plate suitable, the core can be swept at once, and the trouble of ramming saved.

## Barnard's Water and Oil Separator.

The illustrations on this page show a separator for removing entrained or condense water from live steam, and condense water, oil, etc., from exhaust steam.

Separators are rapidly becoming better known and appreciated; long steam pipes—oftentimes uncovered—necessarily condense considerable steam into water; boilers frequently prime, and carry more or less water along with the steam; no matter what may cause the presence of water in live steam pipes, the fact that it is there is a sufficient reason for removing it from the pipe before the steam reaches the engine. Entrained water is an absorbent of heat; it is incapable of performing work in the cylinder, and very liable to wreck an engine or pump, as has frequently occurred. A good separator furnishes practically dry steam, that is, saturated steam without entrained water. The value of dry steam is fully appreciated by engineers, if not by coal dealers.

By separating the oil or grease from the exhaust steam that, after condensation (either in surface condenser or steam heating coils), is used for boiler feed water, the greatest source of expense and labor attending the care and efficiency of boilers is removed. The effect on surface condensers, vacuum pans, feed-water heaters, steam heating pipes, etc., is equally beneficial, as the cleanly and purified condition of the steam admits of no coating of surfaces or formation of dirt or scale.

The design and construction of this separator is of a character that presents a very large and effectual separating surface, together with a liberal port area for the unobstructed passage of steam through the plates, considerably in excess of the area of the connecting pipes.

It consists of a cylindrical shell of cast-iron for the smaller sizes, and of plate iron or steel for the larger sizes, fitted with a sloping channel way, open to the shell. The baffle plates are set at an angle, and are supported by rings fitting the shell. The plates of one ring cover the ports of the next, thus compelling the steam to take a tortuous course through the shell. The oil or water coming in contact with the bars and rings runs down through bored holes at the bottom of the bars into the sloping pocket to the discharge pipe at bottom, where it is drained off. (See cuts 2, 3 and 4.) For use on vertical pipes a different arrangement of rings and plates are used from those shown in our illustration. The effect is practically the same, but, all things considered, horizontal separators are generally to be preferred.

The cut, Fig. 1, shows a special device that will interest engineers and others using surface condensers. It is well known that the vacuum extending from the condenser to the engine cylinder will "hold up" the condense water and oil collected by a separator; in fact, a separator ordinarily used under such conditions is practically useless.

The device shown consists in connecting the waste pipe from the separator to the suction chamber of a pump, and in connecting a second or vacuum pipe, fitted with suitable check valves, to the suction chamber above the suction valves. This places the suction valves of the pump in equilibrium, and enables the pump to continuously draw off the oil and water. The efficiency of this separating device is such that no filtering tank is needed, other than the ordinary hot well, which may be of limited capacity, sufficient to afford solid water for the boiler feed pumps to draw on.

When the separator is used on live steam pipes, the estopped water should be returned directly to the boilers as a matter of economy. The conditions of each plant will determine the best method to be employed for so returning the hot water.

When used on exhaust pipes of non-condensing engines, the condense water and oil may be delivered into a tank if it is desirable to save and filter the oil for further use; if not, then it may be discharged into a sewer, or otherwise disposed of.

The manufacturer of these separators is Geo. A. Barnard, 15 Cortlandt street, New York city.

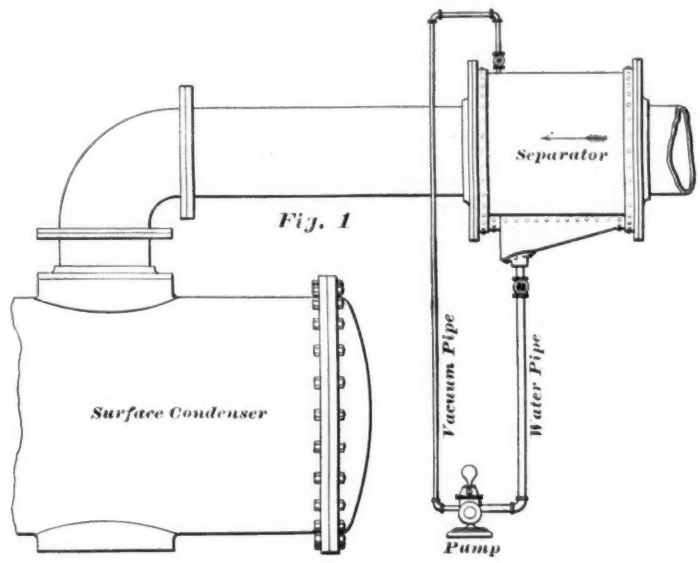



*Fig. 1*

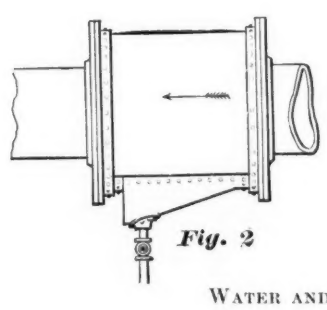


*Fig. 2*

*Fig. 3*

*Fig. 4*

WATER AND OIL SEPARATOR.

## Resistance on Inclined Planes.

Let the line *D E* represent the length, the vertical line *E F* the height, and the horizontal line *D F* the base of an inclined plane; it is required to find the force necessary to haul a given weight or load up the inclined plane.

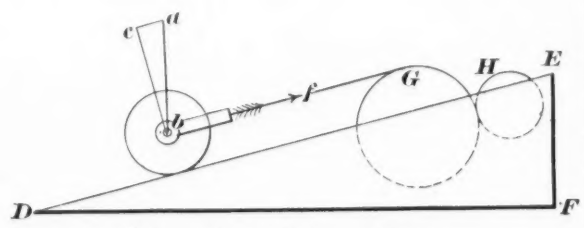
Let the given weight or load be one ton, the height *E F* 12 feet, and the length *D E* 100 feet.

Draw any line *a b* perpendicular to the base *D F*, and make *a b*, say one inch long. Through *b* draw a line *c b*, perpendicular to the inclined plane *D E*, and through *a* draw a line *a c* parallel to *D E*, meeting *b c* in the point *c*. We have here a right-angled triangle *a c b;* the length of its side *a b* represents the total weight of the load, the length of the line *c b* represents the pressure perpendicular to the inclined plane, and the line *c a* represents a force acting parallel to *D E*, and tending to pull the load down the inclined plane.

Now, measuring accurately the line *c a*, we find its length to be $\frac{12}{100}$, or simply .12 of an inch; and, since *a b* represents one ton (2,000 pounds), *c a* must represent $2{,}000 \times .12 = 240$ pounds, which is the force tending to pull the load down the incline, or the resistance which we must overcome in pulling up the load. But this is not the whole resistance to be overcome; we must take the friction into account. Measuring the line *c b*, we find it to be .992 of an inch long, and multiplying .992 by 2,000 pounds, we obtain 1,984 pounds, which is pressure perpendicular to the inclined plane; multiplying this pressure by the proper co-efficient of friction, we obtain the amount of friction to be overcome. Assuming that the co efficient of friction is .004, we have $1{,}984 \times .004 = 7.936$ pounds for the resistance due to friction, and the total resistance to be overcome will be $240 + 7.936 = 247.936$ pounds. Therefore, to pull up the load of one ton, we must exert a force of 247.936 in the direction of *f*, parallel to the inclined plane.

It is not necessary that in every case the line *a b* should be drawn one inch long; we may make it any length, and on it construct the right-angled triangle as explained; then, by measuring the sides *c a* and *c b* with the same scale as used for the line *a b*, we will obtain the same results as before. In fact, since the triangles *a b c* and *D F E* are similar, we may at once obtain the required data by measuring the sides of the triangle *D F E* without drawing the triangle *a c b;* the latter we have only shown here for the sake of illustration. Here we have found the pressure perpendicular to the inclined plane, and the force *c a* by the aid of a graphical method; we may find these forces in a shorter way, as follows:

Divide the height *E F* by the length *D E*, thus, taking the same example as before, we have $\frac{12}{100} = .12$, which is the sine of the angle *E D F*, and multiplying this sine by 2,000 we obtain 240 pounds for the force *c a*, a result precisely the same as before. Now, looking for this sine (.12) in a table of natural sines, etc., we find that the angle *E D F* is 6 degrees and 54 minutes very nearly, and its cosine is .992; multiplying this cosine by the given weight or load, and multiplying the product by the proper coefficient of friction, we obtain 7.936 pounds due to friction as before.




RESISTANCE ON INCLINED PLANES.

Now assume that for hauling the load we have a small hoisting engine, 10″x10″, piston speed, 200 feet per minute; the drum *G* is 4 feet diameter, and geared to make one revolution while the gear *H* on the crank-shaft makes five revolutions; the boiler pressure is 50 pounds per square inch. What load will this engine haul up the inclined plane?

Let us first find the speed which this engine will impart to the load. We know that the piston speed is 200 feet per minute, therefore the number of revolutions of the crank-shaft will be equal to the quotient obtained by dividing the piston speed by twice the length of the stroke. For our purpose it will be best to reduce the piston speed to inches, $200 \times 12 = 2{,}400$ inches; twice the length of the stroke is 20 inches, and $\frac{2{,}400}{20} = 120$ revolutions for the crank-shaft per minute. The drum *G* makes one revolution while the crank-shaft makes five, hence $\frac{120}{5} = 24$ revolutions per minute for the drum. The drum is four feet diameter, its circumference is 12.56 feet, and therefore the speed of the load will be $12.56 \times 24 = 301.44$ feet per minute.

Now assuming that, after the engine friction, etc., has been allowed for, we have 25 pounds per square inch on piston available for hauling, then the total work performed per minute in the cylinder in hauling the load will be equal to product of the cross-sectional area of the cylinder into the steam pressure and into piston speed. The area of a piston 10 inches in diameter is 78.54, hence $78.54 \times 25 \times 200 = 392{,}700$ foot-pounds. Dividing 392,700 by the speed of the load, we have $\frac{392{,}700}{301.44} = 1{,}302.7$ pounds, which is the force exerted in a direction parallel to the inclined plane in hauling the load.

In the beginning of this article we have found that it takes a force of 247.936 pounds to haul one ton, hence $\frac{1{,}302.7}{247.936} = 5.25$ tons, which is the load the engine will haul up the incline. If the engine has two cylinders it will haul 10½ tons.

The coefficient of friction here used is for small cars, the axle journals being in good condition and well lubricated.

## A Word to Moulders.

BY THOMAS WATHEY.

Recently I had, in New York, a conversation with a prominent foundryman in New York, and he expressed the opinion that the moral status of the moulder was no better than it was years ago. I begged to differ, but his argument was rather convincing. His argument reminded me of old times in England—a moulder would go around looking for lodgings, but when he gave himself away as being a moulder, he had hard work to find a place.

Now I think the moulder's trade one of the most honorable in the world, and there must be something in his surroundings that has a good influence on him. Let us see:

Enter a machine shop or pattern shop on a cold winter day, and see how cozy and warm it is there. Go into a foundry on the same day (that is, the generality of them,) and you will find a great difference. In the machine shop the men look so nice and comfortable and warm in their shirt sleeves, while the moulders have to put their fingers in their mouths now and then to keep them warm. If there happens to be a stove in the shop foundry, there is no pipe on it to carry away the sulphur and smoke. It must be, as an old foundry proprietor said once, that smoke is a good thing in the shop, as it keeps out the frost.

But that is a poor excuse for the comfort of the men, as a man can accomplish more work when he is comfortable by one-half than when he is almost frozen to death, as I have been many times.

How long do you think a lot of machinists would work in a shop so full of smoke and sulphur that you could almost cut it with a knife? Not long, you may be sure.

Hearing a conversation going on in the shop the other day about civil service reform, and putting moulders on the police force, a young boy that had been working in the foundry only about three weeks, says: "Why, I should think that they ought to know better than to put moulders on the force."

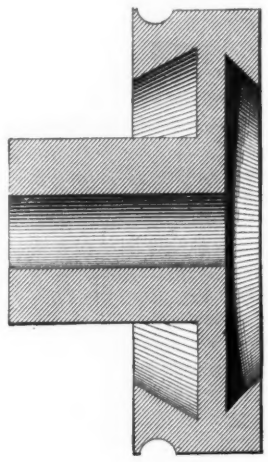
I think it would be a good idea for the foremen in the shops to go around among the men and ask them to take some mechanical paper.

For two or three years back I have distributed papers to the men in the shop; some took one and others two, and they came to look for them every week as anxiously as they did for their dinner, and then, if there was any moulding account in the paper, it was discussed pro and con at dinner time; and I will say this for them, that I never saw a better set of men in a foundry Whether it was the papers that they read or the moral teaching they had, I will leave the reader to infer.

## Screw Machine Work.

On account of the name given to screw machines, many mechanics have the idea that they are intended for and adapted only to the making of screws, studs and similar work. That they are in reality adapted to a large variety of work other than this it is the object of a recently published pamphlet, by the Brown & Sharpe Mfg. Co., to prove.

From this pamphlet we select cuts showing pieces made in their factory at Providence, R. I., on the Nos. 4 and 5 machines, as being good examples of work not thought possible of execution in many shops on screw machines.



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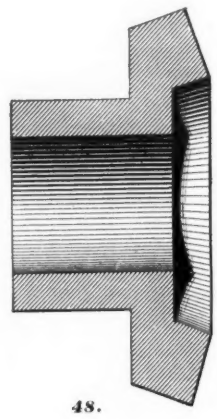

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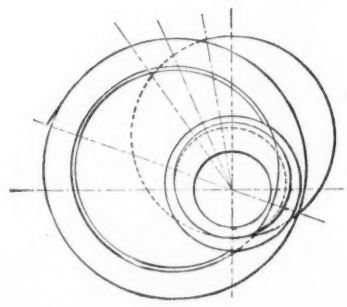
## Force in the Steam Engine, and its Relation to Smooth Running.

BY PROF. JOSEPH TORREY.

FIFTEENTH PAPER.

It is proposed, now, to see how the facts brought out in the last two papers affect the question of shocks at the main bearings. In all well-built high-speed engines of to-day, the "sailing" motion, which results from the combined effect of reciprocating and centrifugal force at the end of the stroke, is corrected by the introduction of a counter-weight, proportioned according to ideas so varied, that no rule or principle could possibly govern or determine its amount, but which opposes its action to that of the reciprocating parts to a greater or less extent. The amount that centrifugal force has to do with shock at the main bearings varies according to the weight of the counterweight. If this be made equal (at the radius of the crank) to the total weight of reciprocating parts, the *inertia forces* will be nearly equal on centers. As long, however, as the connecting rod is measurable in length, they will never be quite equal, but will be a little greater at the back end.



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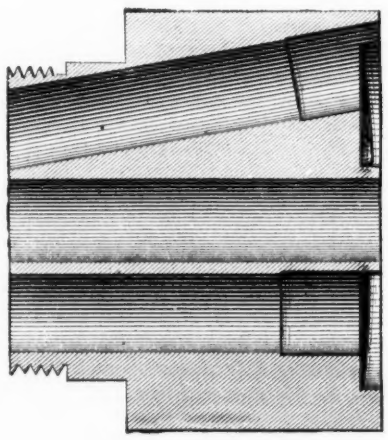
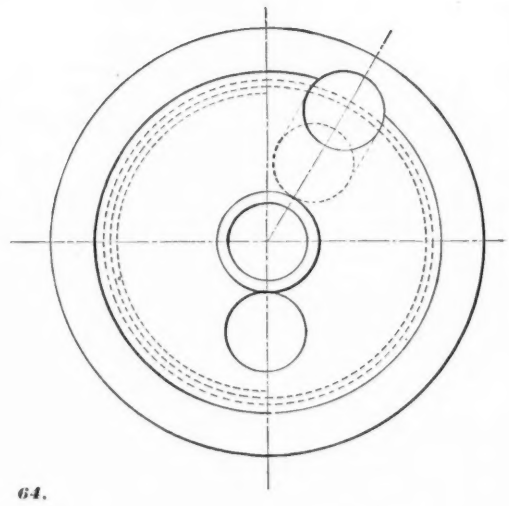
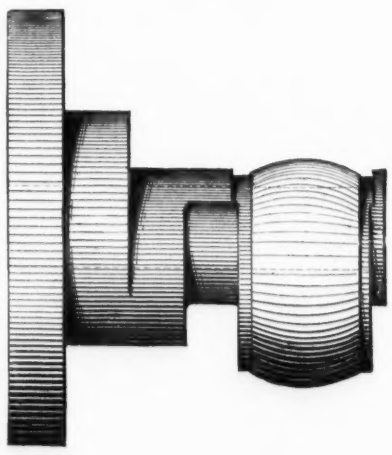




64.

This will be more fully explained in the paper on counterbalance. Evidently, however, whatever portion of the weight of the large end of the connecting rod and crank-pin is counterbalanced by an equal revolving mass opposite it, will be practically fly-wheel, and have no more influence on the distribution of strains at the main bearings than actual fly-wheel; hence the extent to which forces are modified by centrifugal force depends on the amount of counterbalancing attempted.

To emphasize this point, consider the case of a high-speed engine totally unbalanced. At the back end, the impact of steam is exerted forward, of course, and this is resisted by centrifugal force and inertia. Now, suppose a counterweight to be introduced equal to the weight of the reciprocating parts, and the result is that inertia and centrifugal force are mostly neutralized, and the inertia which tends to neutralize steam pressure and mitigate shocks on centers is itself neutralized, and the main bearings (not the pin) take substantially the same shock from the admitted steam they would if there were no inertia in the first place. Here is the great difference between the conditions to which the main bearings and crank-pin are exposed. The counterweight may so operate as to neutralize almost totally the beneficial action of inertia; hence, *it would appear* that high-speed engines, when they are to be balanced as near as may be, should have particular care given to the proportioning and arrangement of the main journals. On the other hand, the crank-pin, no matter what the counterweight may be, always gets the full benefit of inertia, whatever it is, and it would be hardly possible to design a fast engine in which the pin would be exposed to as unfavorable circumstances as the main bearings have to undergo in every case of complete balancing.



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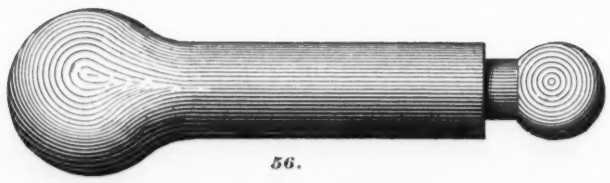

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In a paper read before a meeting of the American Society of Mechanical Engineers, about a year ago, Prof. R. H. Thurston reviewed the subject of "The Distribution of Internal Friction of Engines," giving the results of many new and highly interesting experiments made by himself with a view to locating this loss as far as possible. He shows, among other things, that the crank-shaft friction alone may, and does sometimes amount to 10 per cent. of the total power of the engine, and frequently reaches 5 per cent., constituting in almost every case half the total waste of power. Most of us who are accustomed to use the indicator know that 12 per cent. for a total friction load is an unusual record, and that 17 or 18 per cent. would be nearer common practice. In looking over my friction cards I find one only which runs down to 10 per cent., but I have no duplicate for it. It is well to consider what this means. It means that an engine rated (commercially) at 100 I. H. P. will only transmit to the belt 85 H. P., supposing there is 15 per cent. friction.

Of course it is very easy to speculate on the cause of this enormous waste, but not so easy to find reasons founded on actual fact. The mere fact of constant rotation in one direction does not seem to be sufficient at all; car axles are exposed to much more rapid rotation under very much heavier pressures, and yet the coefficient of friction derived from numerous recorded tests is far less than that of crank shaft friction in the best engine practice. The difference must be in the way the rotation is imparted. An experiment I should like to see tried would be directed toward finding how the crank-shaft friction varied with differently proportioned counter-weights. I am inclined to think some light would be thrown on the subject. I do not see how we can lay the trouble to construction of the journals or journal boxes. It is true there is much careless work done at this point, but there is also much good work, and I believe the journals of some of the modern high-speed engines I could name are as near perfection as anything can be in this world. And yet the tenacity with which the friction hangs to about 10 per cent. as a minimum would *seem* to be ground for supposing the crank-shaft friction remains about the same.

There is just one more cause that occurs to me, and that is the possibility of springing in the crank-shaft or possibly unequal distribution of strains in the engine bed. It would seem, I know, as if the bed designed by Mr. Porter, years ago, and which is standard for high-speed engines at present, was strong enough in any case; but any one who has carefully watched fast running engines knows that in very many cases there is considerable spring in engine beds. In side crank engines the twisting strain is rarely resisted to such an extent as not to be measured by careful work. In center crank engines the question is whether the strains are met and resisted to the same extent by both sides of the bed.

This may all, I admit, be valueless speculation, but it has, at all events, some slight foundation in observed fact.

I have distinctly in mind two cases observed by me last summer. One was a side crank engine, where the twist of the bed was perfectly perceptible, even to moderately careful observation with every stroke. The main journal was heating badly, and all attempts to locate the cause had failed. In this case the cause was unmistakable. I did not have an opportunity to apply the indicator, but I think 15 per cent. total friction would have been a low estimate.

The other case was that of a carefully built double crank disk engine, where the springing of the crank-shaft was detected as follows: The engine was run at a comparatively low speed, the forward end of the connecting rod was covered with chalk, and a steel point was placed in front of the engine so that it could be moved up till it touched the end of the rod and made a mark as the crank came round. Its position was carefully marked, the engine was then speeded up under its full load, the point was brought up again till it touched, and its position was again marked. There was a distance between the two marks of between $\frac{1}{32}''$ and $\frac{1}{16}''$. The marks were not perfect, and exact statement would be absurd. It was greater with full load than with no load at the same speed (within two or three per cent). Very possibly there are reasons why this conclusion, that there was spring somewhere, is premature. I will only say that the tests were made while everything was warm, and so it couldn't all have been expansion. The engine was securely bolted to an excellent foundation of cut stone with a massive granite capstone. I did not know the amount of counterweight, but judged that the balance was quite thorough. The engine did not move horizontally, as was shown by a point at the cylinder head, similar to that used at the other end.

I am inclined, myself, to conclude that there was some spring somewhere. I intend to carry out more such measurements when opportunity offers, but others whose daily experience is much wider than mine can better do it.

In hinting at this line of work, it is more than probable I have suggested nothing that is new. In fact, what I started out to do was rather to suggest some points that young engineers would do well to study, but the whole subject is of such vital interest at

present, that I have been led to give these incomplete and fragmentary results of my own.

### A New Jersey Jobbing Machine Shop.

On the banks of the Arthur Kill, at Elizabethport, N. J., a little below but in plain sight of the B. & O. Railroad bridge, which is already historic from the bitter opposition to its building made by the Pennsylvania Co., The Samuel L. Moore & Sons Co. built, some four years ago, a foundry and machine shop. These works are called "jobbing works," because the company is ready to take a hand at anything in the foundry or machine shop line that comes to hand. But to the mechanic, who always associates with the term jobbing shop a half dozen lathes descended from the primal days of such tools, a couple of planers that get over the course three or four times a day, and something that is called a drill press because there don't seem to be any other title by which to describe it, a visit to the Moore shops will be disappointing. The fact seems to be that when they removed from the old works they forgot to take their old tools, and the result is that the new shops are equipped with the very best modern tools, not only in the ordinary line, but in those lines commonly considered as special.

As intimated, the company does a good deal of machine work—of the better sort—that is called jobbing. This work is mainly in the line of tools and machines that are not in the market as being regularly manufactured. But so far as possible, the arrangement is to do this work on a manufacturing basis, their tools being such as are used in the best manufacturing establishments in the country, and standard sizes and dimensions being maintained by the use of a very complete line of standard gauges.

In addition to their jobbing work, the company does a good deal of work that would be classed under the head of manufacturing. They make, for example, the Straight Line engine, both simple and compound, and there are very few shops in the country that are so well equipped for building steam engines. They have a special machine for boring the cylinders, and the seats for the pillow blocks at the same time; also for milling off the valve faces, milling out the ports and milling the seating for the steam chest cover. This last operation is so well done that the surfaces make a steam joint without further attention. They use an excellent system of jigs and fixtures, covering every operation possible to cover; the engines they build must be as nearly interchangeable in their parts as it is practicable to make such work. We noticed at the works three tandem compound Straight Line engines building, which are to go to Brazil, to be used in electric light plants. The cylinders are 13" and 26" diameter, with a stroke of 18".

In assembling the parts of engines, the line through the cylinder is discarded, and gauges used which show any lack of truth in an exaggerated degree.

For example, for setting the high and low-pressure cylinders in line, instead of a line through the cylinders the pistons on the rod are put in place, then a trial gauge is used, constructed in such a way that a slight variation in moving the pistons back and forth makes the rod move a differential indicator point if the alignment is not correct. The motion of the indicator point being a good many times multiplied with reference to the piston rod, a slight lack of truth will correspondingly impress the beholder. This plan is carried out in lining up guides and other parts of the engine. While this principle of exaggerated movement of an observed point is not new in determining the truth of work, its application can be profitably extended.

The crank-shafts of the Straight Line engine are, as our readers know, "made up," and the final finish—turning and grinding—of the ends is done to bring everything in line with the inserted crank-pin. In order to do this, the centers in the ends of the shaft are located by means of collars, as we have previously explained. Instead of using a spirit level on the crank-pin, by the indication of which the centers are set, a skeleton rod is used, taking hold of the crank-pin like the ordinary connecting rod. Then the centers on the shaft are adjusted until a point on the end of the rod will follow the path of a straight line described on a suitable template, while the shaft is revolved in the lathe. This is an excellent way to accomplish the end sought.

The company also build the Tabor moulding machine, under the supervision of the inventor, Harris Tabor. This is a machine operated by fluid pressure—usually steam—in which the packing of the sand is done, at one operation, by a series of universally jointed rammers. We saw one of these machines experimentally worked on a complicated pattern, doing all the ramming almost instantly, and it made the mould, to all appearances, perfect. This is a machine apparently destined to make a record.

The foundry work of the company has already outgrown the provisions made for it,




SUGGESTED LATHE IMPROVEMENTS.

and they have added to this part of the plant until they now have a foundry 225 feet in length, equipped with a steam crane and traveling cranes, enabling them to handle castings of twenty to twenty-five tons in weight. The company has an excellent reputation for making good, and especially complicated castings, that bids fair to call for still further extension. They have the templates that represent the bore and key-ways of propeller wheels made at the Delamater Works, of New York, and this, with the accompanying record, enables them to get ready new wheels for any of the boats equipped with them, making the delay at the dry dock only that necessary to take off the old wheel and put on the new one. This brings a large amount of work, as the Delamater propeller wheels are in extensive use, and are well appreciated.

A tool-room goes with all modern equipped shops—the company has an excellent one, well supplied with machinery. It is—just as a tool-room ought to be—in charge of a thoroughly competent man, who is not interfered with in his work. Given a certain operation to be performed, and the tool maker devises and has made the special jigs and other tools for the purpose. When a man is put on his mettle, so to speak, the best that is in him is sure to come out, and the tool maker at the Moore's establishment is deserving of all the credit he gets, and that is not stinted.

The Moore Company has a frontage of nearly 300 feet on the Arthur Kill, and there is a fair probability that they will, in the near future, establish shipbuilding works. They are excellently well located for building vessels drawing up to eighteen feet, as vessels of this draught can get to sea from Elizabethport, and coal and iron comes right into the yards by rail.

This sketch would be incomplete without the statement that the president of the company, Samuel L. Moore, is hale and hearty at eighty-eight years, and goes to the shops forenoon and afternoon with the regularity of a workman. The sons, however, attend to the active affairs of the business. The elder Mr. Moore was a locomotive engineer in the early days of railroading in this country, and he could probably successfully contest the title of the oldest locomotive engineer in the country.

*Ironmonger* (London) says:

The condition of the iron and steel trades in Germany appears to be even more excited and more active than we are in this country. Prices are all "on the boom," and the amount of work in hand is altogether abnormal. Some of this briskness is due to the ordinary mercantile demand, but much of it is owing to the gigantic orders which have been given out by the German railway authorities. Some of their orders are the direct outcome of military necessities, but many of the new departures are the results of resolutions to introduce much wanted improvements in connection with the railways of the country. Thus the most intense activity has been created, and the German iron and steel works are full of orders for the greater part of next year.

The city of Meriden, Conn., has issued a very neat souvenir, in honor of the visit to Meriden of the South American delegates to the International American Congress. The maufacturing interests of Meriden are well set forth in the publication, which is very finely illustrated.

## LETTERS FROM PRACTICAL MEN.

### Catching Threads.

*Editor American Machinist:*

In the Nov. 11 issue, Mr. Baker offers a rule for "catching threads" on lathes. In trying to apply it to several practical examples, I met with so much difficulty in making the denominator of fraction in result come right, that I have ventured to send you a rule that I believe to be more practical.

Find the least common multiple of distances between threads on lead screw and screw to be cut; this will give the shortest possible distance that carriage can be run back and catch threads. Then it is evident the whole distance to run carriage back, must be some multiple of this distance, which, of course, can be found by dividing length of screw by given distance and making allowance for "leeway." Example: Screw to be cut, $3\frac{1}{8}$ threads per inch. Lead screw, 4 threads per inch. Length of screw, 23". L. C. M. of $\frac{8}{1}$" and $\frac{4}{1}$ is $\frac{4}{1}$" or $2\frac{1}{2}$" $23" \div 2\frac{1}{2}" = 9+$, therefore we must run back $10" \times 2\frac{1}{2}" = 25"$. F. J. F.

### Some Suggested Lathe Improvements.

*Editor American Machinist:*

I mail you to-day some blue prints of lathe improvements, that I am willing to contribute for the benefit of the trade, if you see fit to publish the same. The taper attachment, I think, may be considered especially novel, though perhaps of a visionary nature.

I have tried (somewhat unsuccessfully) on several different occasions to summon sufficient moral courage to put this device in practical operation; but, notwithstanding this timidity, the device presents so many desirable features that I cannot discard it without submitting it to criticism of other machinists, who are, perhaps, more capable of discrimination. In my mind the question of durability is the only doubtful part of it, and possibly that difficulty may be overcome by increased wearing surface in worm and worm rack. I am deeply interested in any movement toward standard systems, and a system of standard tapers is of first importance. The articles on tapers by your correspondent "Jarno" are of deep interest, as presenting in a clear light the need of reform in this direction, and the advisability of proportionate dimensions; but having decided on these points, the question is how to produce these standards with the greatest precision. A system of change gears, with each plainly lettered $\frac{1}{2}$", $\frac{3}{4}$", 1" to foot, etc., respectively, and having only to slip such gear into place, *a la* screw cutting, would, it seems to me, be near the perfection of handiness. I send my device to you, therefore, simply as a contribution toward the solution of this problem, and thinking that, though the design is faulty, perhaps, it may have suggestions of a perfect taper-turning mechanism, to be evolved from it.

Fig. 1 represents the back side of a lathe-bed and carriage. Fig. 2, a part cross-section on line *a b* of Fig. 1. Fig. 3, a side elevation, showing taper attachment gearing.

*G* is a rack fastened to the back side of the lathe bed, and *F* a large pinion working therein. This pinion *F* is one foot in circumference at the pitch line, and consequently makes one revolution when the lathe carriage *B* has moved one foot. The end of the shaft bearing pinion *F* is arranged to carry different change gears similar to a lead screw on a screw cutting lathe. *E* is a back apron supporting all the gears in the train. *C* is the lower cross slide of a modern taper attachment lathe (here shown with a compound rest). In the under side of the slide *C* is cut a worm rack to fit worm *D*, which is geared to move slide *C* at different speeds, according to the size of change gear on shaft of pinion *F*. The gear *K*, on worm shaft *e*, is not to be changed.

The key shown in the end of the stud which carries the change gear is also ar-

plicable to regular change gears for screw cutting, and is designed to save time in changing gears. Its operation is obvious. The key (*e*) having a spring temper, is made to create sufficient tension at the bottom of the key-way to overcome any tendency of the gear to slip off. It will be noticed that, when the gear is in place, the outer end of the key is in contact with the bottom of the key-way in the lead screw, as well as in the gear. This forms practically a solid key, but any required tension may be obtained by varying the length of the key. The end of the key is rounded, to facilitate entering the gears. In operation it is only necessary to pull off and push on the gear when making changes. O. S. WALKER.

Worcester, Mass.

### A Model Engine.

*Editor American Machinist:*

In your issue of December 5 you show a fine model illustrative of the action of the valve and link motions of the steam engine.

Such models are very useful in the investigation and adjustment of the movements of complex machinery. The present illustration represents a model designed to investigate the four-valve system of gearing of the "Corliss" type, without its detached feature, to see if it could be applied to the locomotive, and other quick-motioned engines. The flat gridiron valve is used because it requires but a very short motion. Quarter-inch inlets and half-inch outlets, with a quarter of an inch lap of valves, require but five-eighths of an inch movement for the inlet, and seven-eighths of an inch for the exhaust valve. The model is designed upon this proportion, and is arranged in as compact form as possible, and yet give the correct proportion to crank, rods and motions. Only four ports are shown in model, but the number may be extended, of course, according to size of engine, without increasing their width. The arrows and dotted lines indicate its operation; the piston *P* is shown at one-third of its stroke to the right. The links *a* are so connected with the rockers, *b*, that while the inlet valves, *e*, are opening and closing their ports, the exhaust valves *d* are nearly stationary upon their closed ports, and vice versa; this feature is well understood by engineers, and it renders the adjustment of the four-valve systems quite easy and perfect. By varying the length of the eccentric rod *e* a trifle, and screwing the valve stems, *f*, more or less into their valves, and varying the length of the rocker arm *g* to which the eccentric rod is connected, almost any desired action may be effected. The model here represented is chiefly of hard wood, 9x11", which is sufficiently large to illustrate accurately the action of the system. I once saw in the office of that excellent mechanic, George S. Griggs, for many years superintendent of the locomotive department of the Boston & Providence Railroad, a model locomotive rudely made of wood, full-size. It was fixed up upon one side of the office, and illustrated to the eye every motion of the engine in its due proportion. Mr. Griggs built many locomotives for the company, and this model must have been a great help to him in designing and adjusting his engines. But a model simply for investigating and showing the action of a locomotive perfectly need not exceed twelve to fifteen inches in length. F. G. WOODWARD.

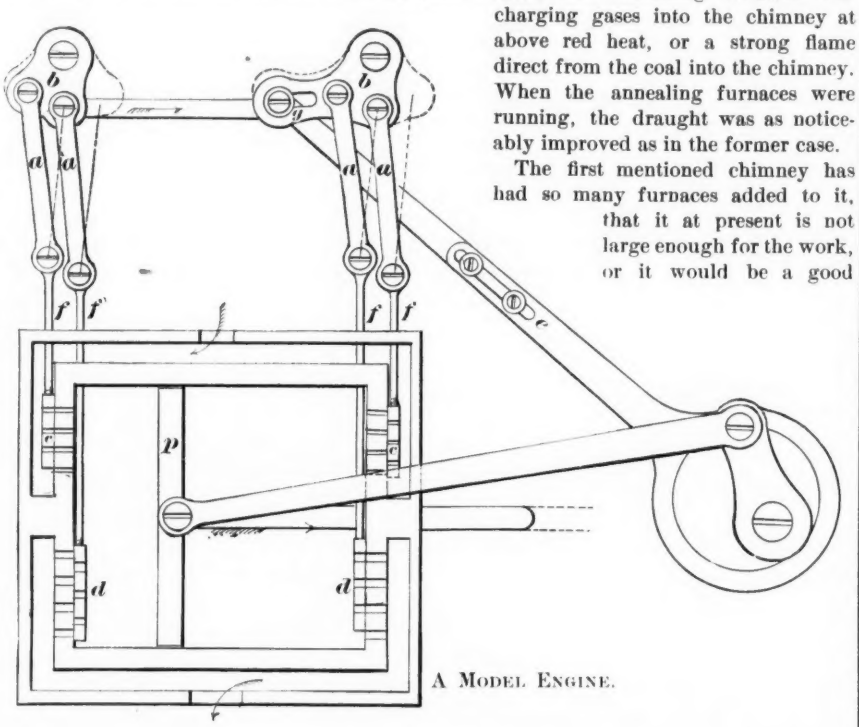
### Care of Tools.

*Editor American Machinist:*

"Young man, the secret of doing good work is look well to the condition of your tools." The above advice was given to an apprentice by an elder shopmate some years ago. The writer, to whom the advice was given, paid but little attention to it at the time, but in later years has thought of it often; and of its philosophy, as applied to shop practice, there can be no question. As a rule, the condition of a mechanic's tools will indicate the quality of his work. I do not mean by this that a man with a rosewood tool-chest, made in cabinet form and filled with an expensive set of tools, necessarily implies a good workman, but rather, if a machinist, look at his lathe board, examine his diamond point and other cutting tools, and see if they are in proper shape to do the work required.

Some men make a practice of never putting away a tool without grinding ready for immediate use, while others never grind a tool unless obliged to use it, and would rather borrow from their neighbor than grind their own. It is not difficult to tell which of these two will accomplish the most, both for themselves and the firm they work for. The modern tool-room, properly equipped, takes from the machinist a large part of the labor of keeping tools in proper repair, but removes from him none of the responsibility for the work the tools will do; for, though the tool-room may exercise its best judgment in the preparation of a tool, there may be conditions in the work that the tool-room has no knowledge of, so that the workman should not take for granted that, as the tool came from the tool-room, it must be all right, bu t take into accout the work he has to do, then the tool-room becomes what it should be—a valuable aid to the workman.

TOOL-ROOM.




A MODEL ENGINE.

### Chimney Draught.

*Editor American Machinist:*

We find it set down in books that 600 degrees is the maximum temperature of a chimney, or that a higher temperature will not increase the draught. This calculation appears to be based on the weight and volume of air, rather than a careful experiment.

Some years ago, a manufacturing concern built a square chimney 148 feet high, and a flue 4 feet square. At first there was connected to this chimney three boilers, one having 42 feet grate area, and the other two 46 feet area. The first delivered gases into the chimney at about 350 degrees, and the other two at about 650 degrees on the average. The draught was not very good, no better than could have been expected from a much smaller chimney.

Afterwards there were connected 42 furnaces, each having 1.36 square feet area, and used for melting copper and its alloys. These furnaces delivered gases into the chimney considerably above a red heat, and burned about 35 pounds of coal per hour per square foot of grate.

In addition to the gases from the coal, there was also the fumes from the spelter, which at times is considerable. After these furnaces were added, the draught was improved so much that fully double the coal could be burned under the boilers. It may be claimed that this temperature was not maintained to the top of the chimney. Have there been any experiments that show what the average temperature is in a chimney from a certain temperature at the bottom?

In connection with this, in a recent conversation with an engineer on this subject, he mentioned a chimney that, in addition to the boilers, had annealing furnaces discharging gases into the chimney at above red heat, or a strong flame direct from the coal into the chimney. When the annealing furnaces were running, the draught was as noticeably improved as in the former case.

The first mentioned chimney has had so many furnaces added to it, that it at present is not large enough for the work, or it would be a good opportunity to make some scientific tests. This chimney has a straight flue from bottom to top. It is double all the way, and there seems no chance for air to leak into it. When we attempt to cool off a chimney we find that it takes a long time and a large volume of air; but the heating up is much more quickly done, especially if the chimney has been in use for some time.

I am under the impression that our insurance men would rather see the temperature at the bottom of an elevator shaft remain at 600 degrees, than have it 1,000, on account of the draught alone.

W. E. CRANE.

### Ingenuity in the Foundry.

*Editor American Machinist:*

It is not always the large castings that are the most difficult to mould, or that require the most brain work to determine which is the cheapest and best way to accomplish the desired result. There are not many classes of mechanics who, with the limited resources at their command, have a better opportunity to display their inventive genius than the moulders in a jobbing foundry.

For instance, not along ago a party came into the shop with a cone pulley, of the following size; large step, 10" diameter, 2" face; small one, 9½" diameter, 2" face; from which was wanted a pattern, in halves. As the pulley from which the pattern had to be made was turned to finished size, there had to be an allowance for shrinkage and finish on patterns. To overcome this difficulty, two blocks of the required thickness ½" larger than the outside diameter of the steps of pulley, were sawed out; and a one-inch hole bored in the center of them, to receive the wooden pin *A*, shown in Fig. 2, the use of which will be developed as we progress. Those blocks were rammed up and moulded in the usual manner. In drawing them from the sand, the pin *A* was left in the mould, as seen at Fig. 1, for the purpose of centering the pulley casting *C*, especially so in moulding the small half; as the outside of the mould could not be seen, because of the upper step projecting over the joint of mould, as at *B*, Fig. 1. After the casting *C* was set into the moulds formed by these blocks, it was rammed up inside, and a joint made at the middle of the arms; which would be on a level with joint B. Having withdrawn pulley casting *C*, the pin *A* can be removed, and the vacancy caused thereby can be filled up, or used for core print. By closing on the plain copes, formed by the aforementioned blocks, completed the job in good shape.

GEORGE O. VAIR.

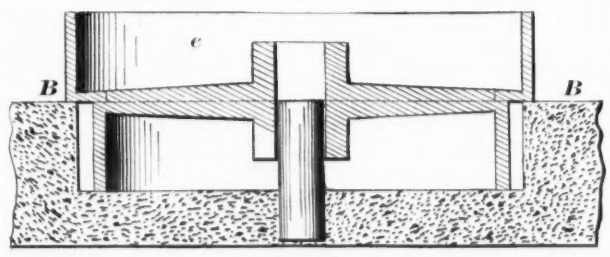



*Fig. 1*

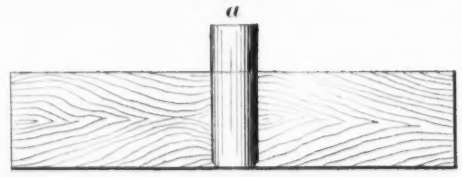



*Fig. 2*

INGENUITY IN THE FOUNDRY.

The next meeting of the Institute of Mining Engineers will be held at Washington, D. C., beginning on Tuesday evening, February 18, 1890. General W. S. Rosecrans is chairman of the local committee, and the secretary, to whom all communications should be addressed. At one of the sessions of this meeting, to be hereafter determined, the manufacture, properties and uses of aluminum will be specially considered. Papers in this connection from Messrs. A. E. Hunt, F. P. Dewey and W. J. Keep have been already announced, and others of suitable character will be welcome. Opportunity will also be given for the discussion of Mr. Keep's paper on "Aluminum in Cast-iron," read by title at the Ottawa meeting and recently distributed. Written communications from members interested in the subject, but unable to be present at the meeting, are earnestly invited.

To what an extent facts gathered from experience will overturn theory is well seen in the instance of the compound engine. It is but a few years ago that the utility of the compound engine in mills was opposed by most of the engineers in this country. Now it looks as if in a few years the simple condensing engine for large power would be a curiosity. And as the practice of compounding comes to be better understood, it is extending to small sizes. Higher steam pressures and compounding are having an important influence in reducing the cost of motive power.

It is rather an advantage, sometimes, to look near home for what you want. The above is brought to mind from a knowledge of the experience of two ladies who went to New York shopping from a city near by. They utterly failed to find what they wanted in the big city, and returning home found exactly what they were looking after. There is a good-sized moral in the experience of these two ladies, and it is applicable to a good many other things besides shopping.

The Boston *Transcript* concludes that it would be a good thing if the names of architects were conspicuously displayed on buildings they had planned, as "it would save so much time to persons who purpose to build, in making up a list of architects to be avoided." It isn't a bad idea.

The latest pipe scheme is that of supplying New York City with milk through a pipe line. What a convenient thing it will be, to be sure, to have milk on tap, like water.

It is said that in some German cities the asphalt pavement is being seriously injured by the escape of gas from the soil.

## Amateur Engineering.

BY DR. R. H. THURSTON.

America, the home of the free, the refuge of the oppressed of all nationalities—except the Chinese—the land of unlimited privilege as respects politicians, "heelers," government contractors, and Indian agents, the country in which the rights of individuals are forgotten where the interests of many are concerned, and the paradise of the vendor of silver, exhibits one aspect of "freedom" which, to the unsophisticated citizen of the old world, is more extraordinary than perhaps any other among the thousand singular developments of liberty which here attract his attention; this is the freedom accorded to the amateur to enter into the serious work of the professional.

The *Engineering News* of the 14th December, criticising the organization of the naval bureau of yards and docks, in which amateurs and non-professionals are endeavoring to do the duty of the skilled engineer, in the expenditure, upon important works, of between one and two millions of dollars a year, quotes the old proverb, "Every man to his trade," and makes direct application of it to that case. But perhaps the most remarkably typical illustration of the readiness of one man to take up the trade of another, and of the singular trustfulness of officials and people in his ability to do so successfully, is seen in the proposal, made apparently with perfect seriousness, of a distinguished lawyer in Congress, who happens to be on the Naval Committee of the House of Representatives, to *design an iron-clad*. A description of this proposed war-ship is given in the *Iron Age*, of December 12th; but we find no reference in the pages of that paper to the fact that the proposal illustrates most admirably, not so much the versatility of our people, and the ease with which the average American will go about the construction of anything under the sun, whether he has served an apprenticeship to the business or not, as the glorious freedom of which this particular aspect is so impressive to the foreigner visiting our shores.

It may well be doubted if in any other country in the world a lawyer can be found, however talented and distinguished, or however "influential," who would gravely propose that he be permitted to design that grandest of all the works of the engineer, the modern iron-clad; nor would it be possible, probably, to find another country, on either continent, in which those who are charged with that duty would not resent the interference of the amateur, and in which he would not be laughed to scorn by the people. Whether it may be truthfully urged in his favor, however, that the officials of the bureaux of construction and of engineering of the navy department are, as professionals, less competent to do their work, than is this amateur, we are not informed; but we have at least no doubt on this point: that if they are less competent than the most talented of amateurs, they should be promptly invited by the Secretary of the Navy to retire from their comfortable berths, and a place should be made, if thus necessary, for competent professionals from civil life. If they are competent, they should be permitted to do their duty unhampered by costly and embarrassing toying with work affecting the safety and the honor of the country, by any amateur.

We, as tax-payers, cannot afford to entrust such work, or the expenditure of a million and a half dollars, to any but wise and experienced hands. Nor can the country afford to trust as members of important committees, men who have so little appreciation of the common-sense principles of business or of the amenities of official life, as to volunteer their crude opinions where they are least informed.

## Gusset Stays.

BY W. H. BOOTH.

Without entering into the question of the superiority or otherwise of gusset stays over stays of other descriptions, it is apparent that just at present gussets are often applied in situations where bar and palm stays have hitherto usually been employed. Too frequently, however, it will be noticed that gussets exposed to a considerable stress are very faultily designed for the stresses to which they will be subjected.

In the annexed cut is represented a gusset stay with a good riveted attachment to the parts of a boiler to be stayed, and well shaped for withstanding the stress brought upon it, and which is probably always greatest at the edge *A*. Very frequently, however, this edge is found hollowed, as shown by the dotted line, and the tendency is to rip across at *c*, for the plate is exposed to a severe cross-breaking stress, whereas, when shaped as shown by full line, the material of the gusset resists by direct tension rather than by cross-breaking strength.

Wherever possible it should be observed as a hard and fast rule that the edge of a gusset stay should project something beyond the straight line joining the outer corners of the angle or tee iron attachments.

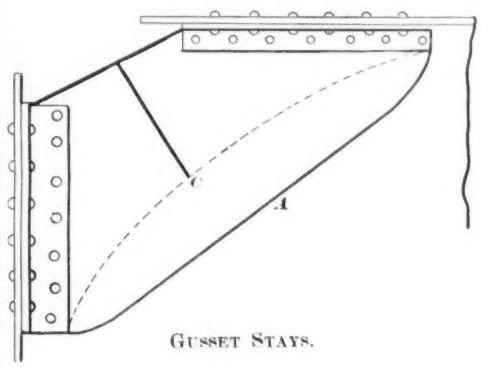
Frequently, too, gusset stay edges are left rough from the shears, or even as a series of small semi-circles from the plate, being a piece of scrap cut out by means of drilling In all work having any claim to be considered good, the edges should be even and straight, with the arris removed by the file.

When of steel, and sheared, the sheared edges ought to be planed off or the whole stay annealed after shearing.

When too great rigidity is given to a flat-end plate by a gusset stay, a good remedy is to remove a rivet or two connecting the stay to the angle iron at the points where greater elasticity is required.

In staying the flat ends of a boiler by gussets, it is a usual practice to attach to the first ring of shell plating. If the pressures are high, a gusset acts to far better advantage when it extends as far as the second ring of plating, the disposition of stresses being then more favorable.

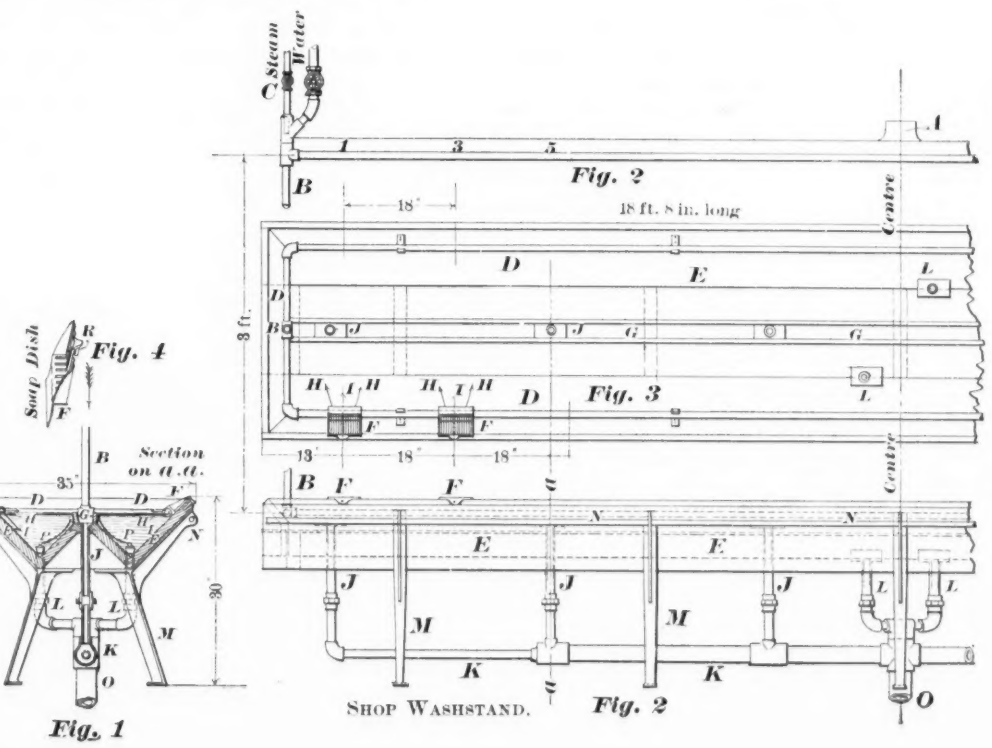
In large boilers of the internally fired description, such as the Lancashire, there are usually five gusset stays. At each end above the tubes of these, the central gusset will be attached to the first two rings of shell plating; the two next will hold on to the first ring, whilst the outer gussets are attached only to the second ring of plate. This arrangement is often reversed for the back end, on account of the manhole or other fitting block occupying the crown of the second shell ring, and in such case, and, indeed, usually, the central back-end gusset holds to the first shell ring, the other gussets alternating, as at the front end. Gusset stays are but bar stays flattened out in order to facilitate their attachment over a large area of plate, so avoiding the severe local stresses which arise when a heavy bar is employed to hold a considerable area of plate from a central point in that area. The gusset holds on a line drawn across the stayed area. Being then only a modified tension stay, it must be designed as such, and in good practice is nearly always found attached by two angle irons, not by single angles, single flanging, or by a T iron, especially when in a position of importance.




GUSSET STAYS.

## Shop Washstand.

We herewith give an illustration of a shop washstand, designed by John Royle & Sons, Paterson, N. J. The aim of the designers was to provide each man with clean water, no matter how many men may wash at one time. Fig. 1 represents a section; Fig. 2 an elevation; and Fig. 3 a plan of the stand. It consists of two wooden troughs *E E*, separated by a waste-water channel *G*. A supply pipe, *D D*, extends around the inner surface of the troughs *E*; the center of this pipe, and the edges of the channel *G*, are placed in the same horizontal plane; at intervals of 18 inches apart the pipe *D* is perforated by three small holes: two of these, marked *H H*, cause a horizontal current of water to flow towards *G*, and the hole *I* gives a current flowing in a diagonal direction, tending to lift the water from the bottom of the trough into the channel *G*. The pipe *D* takes its supply from *B*, the water in *B* is raised to any desirable temperature by means of a small jet of steam flowing through *C*. As soon as the water level reaches the edges of the channel *G*, the water flows into it, discharging in currents the soapsuds, etc., leaving the water in the trough comparatively clean. The waste pipes *J* conduct the impregnated water into *K*, and from thence it is conducted through *O*, into the sewer. The soap dishes, of which a separate view is shown, Fig. 4, are placed near the streams, *H H I*, so as to be in a convenient position for the men; these dishes are held in position simply by a small pin *R*, inserted in a brass bushing, the latter being driven into the edge of the trough. *M M* are cast-iron stands, and *N*, towel racks. The numbers 1, 3, 5, painted on the upper cross-bar, are for purpose of designating the place assigned to each man, so as to avoid a confusion of towels and soap. This device works excellently; it is not patented.




SHOP WASHSTAND.

LUCID.—On board an ocean steamer a gentleman wished to help a lady, who was of an inquiring mind, to comprehend the principle of the steam engine. This is how he cleared away all difficulties:

"Why, you see, ma'am," quoth he, "it's just one thing goes up, and then another thing comes down, and then they let the smoke on, which makes the wheels go round. That's what they call the hydraulic principle. It's quite simple when you know it."

"Law me, I never understood it before! But then, I never had it properly explained," replied the fair listener.—*Youth's Companion*.

How the daily press handle engineering matters is rather neatly shown in the following, which we copy from a daily that in other matters is quite exact in its statements:

An important discovery in naval construction is now occupying the attention of the authorities in England. All engineers know how important it is to have equal temperature of water throughout a boiler, so preventing a dangerous increase of temperature of the fire surface when exposed by reason of low water. An automatic machine has been invented by which the engineer is able to find a low stage of water which may be safely carried in the boiler.

It is again emphasized—this time at Chicago—that dust from almost anything will explode. Flour-mill dust causes serious explosions, and coal-dust frequently explodes with disastrous results. The Chicago explosion was of dust from shavings from a furniture factory. A spark ignited the dust, and the result was serious injury to several men who were in the room. Look out for dust of any kind.

What a wonderful bill, to be sure, is that which the World's Fair Committee of New York propose to get before Congress. It is elaborate—beyond question—and long—beyond reason. It is one of those bills upon the draft of which a blue pencil could have been used to excellent advantage.

The mechanics employed by the Seneca Falls (N. Y.) Mfg. Co. have formed a club for self-improvement. They have, at considerable expense, furnished a suite of rooms. The club is known as the A. S. D. Mechanics Club.

There has recently been a new war ship launched in France, and if she makes a speed of 20 knots, which it is expected she will do, the builders will get the comfortable bonus of a million francs.

Agent—Suppose you let me write a policy on this building.

Owner—Why, it's fireproof.

Agent (retreating)—I didn't know that. Pardon me, I wouldn't take it.—*The Sun*.

The *Manufacturers' Record* comes to us this week in a remarkably neat cover. It looks better than ever before on the outside, and there is no evidence of falling off on the inside.

It is said that a wealthy syndicate of Chinese merchants has obtained concessions enabling it to control electric lighting in China.

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## Use and Abuse.

It is a well-recognized fact that a large part of the energy expended by the human race is put forth in correcting the mistakes and errors committed by predecessors in the same line, or removing the evil effects of such mistakes. While this is more generally true of doctors than of any other calling, perhaps, yet it is largely true of engineers and machinists also. But designers of machinery have not only to correct or remove the consequences of mistakes which have already taken place, but they must in many cases provide for mistakes and blunders which experience or analogous reasoning show will in all probability be made. It quite often happens that the most expensive feature of a machine is introduced for the sole purpose of providing against the ignorant or careless blunders of those who are to use it. Every experienced tool maker knows that one of the points to be looked out for in designing a jig is to so make it, if possible, that the piece for which it is made can by no possibility be put in any other way but the right way. This cannot always be done, and whenever, for this or any other reason, it is not done, the penalty is almost sure to be paid, some time, in the shape of a lot of spoiled work.

So it is in many lines of machinery, especially that which is usually managed by those possessing little or no knowledge of it. It is a regularly recognized principle that not only fair usage must be provided for, but entirely useless and unreasonable abuse as well. It is notorious that many of the small bolts and other fastenings about machine tools must be proportioned, not to the legitimate work they have to do, but to the brute strength of the mechanic (?) who handles them. It was formerly quite common to make the screws which held the dogs in place at the side of planer platens, with a small handle on them, so they could be easily tightened up by hand. The man who first made them so, reasoned, correctly no doubt, that, as these dogs had nothing to do but move a lever, which could be easily moved by two fingers of the hand, it would be much more convenient to have them tighten by hand, without the necessity for picking up a wrench for the purpose. He failed to take into account the individual who, when he tightens a bolt or nut, never bothers himself with thinking anything about the size of it, nor what it has to do, but simply tightens it up as tight as Providence and his strength will let him. This jammer instinctively felt that he could come nowhere near breaking these screws by the handle alone, so he invariably supplemented his strength with a hammer or wrench, with which he soon beat the neatly turned handle out of all resemblance to its original shape, and strained the screw beyond the possibility of being tightened in the legitimate way. Nuts to be tightened by wrenches are used now, not because they are better for the real work to be done, but because the jammer must be provided for.

Successful globe valves must be made not to hold steam simply, but to resist the strength of the fellow who thinks (assuming that he thinks at all) that a valve is not tightened sufficiently so long as it can by foul means or fair be tightened more. Numerous instances of the same kind might be given, but perhaps these are enough to have a somewhat depressing effect upon some reader whose lot it is to bend over the drawing-board, trying to proportion things for the work they may properly be supposed to do. But there is one consolation, and that is that the one who makes the blunders in the long run usually has to bear the burden of the consequences, and the jammer or his employer has to pay for his fun in the end.

## Street Railway Propulsion.

Whatever may be said regarding the various substitutes for horses in the propulsion of street cars, it can scarcely be doubted that any one of them possesses advantages over that ancient method of locomotion. There can scarcely be a reasonable doubt that the substitution of any of the leading means of propulsion for the horses or mules would in almost every instance be a benefit to all parties concerned, and to none more than the people who live or do business along the line. And yet we hear a good deal in regard to getting the consent of property owners along a line of road on which it is proposed to change to one of the modern systems of propulsion, and the tone of the discussion regarding the matter seems to indicate that a good many people consider that it is to be taken for granted that such a change is necessarily an injury to property owners along the line, for which they should in some form be compensated, the only question being as to what the rate of compensation shall be. There are many good arguments in favor of charging a street railroad company or other corporation for the use of public streets, in which to carry on money-making operations; but having secured the use of the streets, with or without payment, therefor, we can see no philosophy in fining them for making a change or improvement which can hardly injure any one in the least, and is almost sure to be a decided benefit to all concerned. There is no justice in mulcting a corporation simply because it is a corporation and some one has the power to do it. And we do not see just why property owners should be allowed to stand in the way of an improvement for which there is a public demand, when such improvement injures no one. Any of the systems of power propulsion in common use are more quiet, more cleanly, more rapid and more merciful than the use of horses, have a decided tendency to increase the capacity for business of crowded thoroughfares, and are generally better in almost every way. No mere whims should be allowed to stand in the way of their adoption.

## Trusts on Wall Street.

It is probable that nothing has occurred in connection with trusts which will do more to destroy them than the movement upon Wall street, which has taken place by their promoters, and has resulted in heavy losses to the gamblers who meddled with the trust certificates. No one outside the trusts had any means of judging accurately the real value represented by these certificates, and when the gamblers who held them found that certificates had been issued far in excess of the real or prospective value of the properties included in the formation of the trust, and that it would be an utter impossibility for dividends or interest to be earned on them, Wall street found that it had been fleeced, and trusts for the first time became unpopular in financial centers. Wall street evidently thought that a new method had been discovered by which it could safely fleece the public; instead of which, Wall street was itself fleeced. Those who went after wool got shorn, which is a good thing for the public in several ways, but principally because it turned the threatened favorable influence of Wall street into indifference, if not positive opposition to trusts.

Some months ago, when the speculative trading in these certificates had but just fairly been commenced, the *Shipping and Commercial List*, in commenting editorially on the new movement said:

"There is nothing, however, that will strengthen these trusts more in the estimation of the public than the distribution of several millions of their stock among small holders, who are at the same time investors. As a rule, people are willing to pay a little more for sugar, or gas, or paint, if they are also the recipients of fat dividends from any of the above trusts."

Now, of course, the editor well knew that the vast majority of the people who would be compelled to pay increased prices for their sugar, gas, paint, etc., would never hold any stock in these trusts, and what he meant by "people" are those who have a surplus of money for investment in stocks, or who make a business of trading in them. By this comment the editor unconsciously showed how completely the people of the country (using the term in the broad sense) are ignored in such circles as his paper caters to.

But his words also show a clear recognition of the fact that those whom he calls "the people" have the paramount influence in almost all matters which affect the welfare of trusts and all such schemes for making money without earning it. It is cause for self-congratulation by the real people that the *Shipping and Commercial List's* "people" have been shown that it is dangerous for them to meddle with trust certificates.

## The People Triumph.

New York City seems at last to have found, in the latest decision of the courts, a solution of the electric wire question, and the electric companies are paying the penalty of their past disregard of the rights of citizens and of human life. The wires are being unceremoniously cut down, and the entire business of electric lighting seems to be in a fair way to be abolished, until it can be resumed on a new basis, which will probably not be as favorable to the companies as they might have obtained had they condescended to pay some attention to methods of preventing wholesale killing.

It may as well be recognized first as last that in the end the voice of the people will prevail in such matters as this, and in all others in which their rights to life, liberty and happiness are encroached upon. And the further these encroachments are carried, the more severe and disastrous will be the final reckoning. The most violent explosions occur where the resistance to the explosive force is greatest.

## Literary Notes.

A MANUAL OF MACHINE CONSTRUCTION FOR ENGINEERS, DRAFTSMEN AND MECHANICS: embracing Examples, Rules, Tables and References. By John Richards.

This book is thoroughly practical; it is not a work of instruction so much as a book of direct application, intended to meet the every-day wants of the practical engineer or draftsman, and the mechanic in his workshop. The tables, rules, and data for engineering and mechanical work relate to things most commonly dealt with, and comprise selections made by noting for a number of years the relative frequency of reference to the different subjects met with in practice. The work is made up mainly from personal experience obtained through a period of thirty-five years at home and abroad.

The book is divided into six sections, treating on machine design; transmission of power; steam machinery; hydraulics; processes and properties, tables and memoranda. Each alternate page of the book is left blank for convenience in reference, and also to receive the owner's notes and original matter. Draftsmen and mechanics will find the book to be a valuable one—it will aid them in designing certain classes of machinery. The book is published by J. B. Lippincott Company, Philadelphia. Price, $5.00.

## QUESTIONS AND ANSWERS.

*Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.*

*Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.*

(467) W. B., Marion, O., asks: Is there any rule for turning cone pulleys? If the rule has been published in your paper, what number is it in? *A.*—You will find the subject treated in the issue of Dec. 1, 1888.

(468) W. S., Sherbrooke, P. Q., asks: Which is the longest and heaviest bridge in the world? *A.*—We do not keep a record of the bridges built; some of our readers may give the information.

(469) R. S. G., ———, asks: Will you please give a rule to determine the angle to set a compound rest to turn any desired taper? *A.*—You will find a rule given in the answer to Question 395, issue of Oct. 24.

(470) E. T. D., Milbank, S. D., asks: Will a steel patch, five feet long, work good on an iron boiler directly over the grates? *A.*—Steel patches on iron boilers are dangerous, and should not be used. The unequal expansion of the two metals will cause trouble.

(471) W. B., ———, N. J., writes: Please give the horse-power of stationary plain slide valve engine with Water's governor. Diameter of cylinder, 13 inches; stroke, 15 inches; 200 revolutions per minute; boiler pressure, 80 pounds; steam pipe, 3½ inches. *A.*—About 80 indicated horse-power.

(472) D. C. L., ———, Ohio, asks: Is there a book which contains the questions which an applicant for an engineer's license must answer? If so, please let me know where I can get one. *A.*—There is no book of this kind published, for the simple reason that the examiners do not adopt a regular set of questions, but ask such questions as will determine the applicant's fitness for the position he seeks.

(473) C. E. K., Watertown, N. Y., asks: Will you please inform me where, in this country, planers are built that will accurately plane a semi-circle of any desired radius? I do not mean the radius planers used in locomotive shops for planing links, etc. *A.*—We do not think that such planers are built in this country at all; at least we do not know of any. Such work is usually done by an attachment to the regular planer.

(474) A. S., New York, asks: Who has the best equipped fire department in the world, and who comes second and third? We had a little argument over this question; one claims New York and the other Berlin, but leave it for you to decide. *A.*—We believe it is safe to say that the best equipped fire departments will be found in some of the large cities in the United States; which is second and third we cannot undertake to decide.

(475) L. H., Holyoke, Mass., writes: In determining the result of a boiler test, what course should be pursued in the following case: The feed water is pumped through a coil of pipes in the boiler flue, similar to an economizer. Should the temperature of the water, after coming from the economizer, be taken as the temperature of the feed water, or before passing through the economizer—no exhaust being used to heat the water? *A.*—The temperature of the feed water before it enters the economizer should be taken.

(476) J. N. H., Baltimore, Md., writes: I have made some marble ornaments, and tried to polish them with oxalic acid, but the polish is not satisfactory, and I think something else is used in connection with it; if so, please inform me what it is. *A.*—We do not know of any other way to polish marble than with fine emery powder and a piece of felt, and rub the marble until it appears with a comparative gloss on its surface. Afterwards finish the polish with putty powder and fine clean rags. As soon as the face appears of a good gloss, do not put any more powder on the rags, but rub it well, and in a short time it will have a fine polish.

(477) A. E. D., ———, asks: Can you tell me which is the shortest and most direct way of finding the size to turn a gear wheel when the number of teeth to be cut in it is given, and also the distance from center to center of the teeth is given, and is there a way of proving the result to see if it is correct? *A.*—You will find formulas for this in the answer to Question 126, issue of March 14. These, however, give the diameter at the pitch line only, to which must be added twice the height of the teeth above the pitch line, or the working depth of the tooth, to obtain the whole diameter. The correctness of the operations involved can, of course, be proven by reversal, as is explained in common arithmetics.

(478) C. F., Dansville, N. Y., writes: We have a mud drum on our boiler. The outside diameter of the drum is 16 inches, length, 22 inches; the circular part of the drum is ⅝ of an inch thick; head, ¾ of an inch. I would like to know how much pressure it will stand. *A.*—You do not state whether the drum is made of iron or steel. Assuming it to be made of iron, and single-riveted, it will stand a pressure of about 292 pounds per square inch, provided the drum is kept free from mud and is not overheated. Whether the boiler will stand this pressure we do not know, as you have not given its dimensions. The fact that drums are liable to become filled with mud, and corrode, make them dangerous adjuncts. We prefer not to use them.

(479) C. C., Brooklyn, N. Y., sends us a sketch of a cast-iron column with brackets; the brackets are comparatively short, and the ribs underneath them are very deep, and asks for a rule to compute the strength of the brackets. *A.*—For practical purposes we may assume that fracture is caused by shearing. The shearing strength is proportional to the area sheared, and is independent of the form. Therefore multiply the area in square inches of the deepest section of the bracket by the safe shearing stress, say 4,000 pounds per square inch; the product will be the load in pounds which the bracket can carry. Whether the column will support this load depends not only on thickness of the metal, but it is also affected by the ratio of the length to the diameter of the column, which you have not given.


## BUSINESS SPECIALS

*Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.*

Gear wheels and g-cutting. Grant, see adv., p. 16.

Link-Belting and Sprocket Wheels.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc., J. B. Roney, Lynn, Mass.

Duplex Gear Cutters. R. M. Clough, Meriden, Ct.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells, & Co., cor. Fulton and Dutch sts., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

Ice and Refrigerating Machines, 140 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

"How to Keep Boilers Clean." A 96-page book mailed free by Jas. E. Hotchkiss, 120 Liberty st., N.Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Prestoline & Prestoline Paste, for cleaning & polishing metals. S. A. Smith, 23 S. Canal st., Chicago.

Round Adjustable, Round Solid, and Square Dies, all sizes. Mfd. by S. W. Card & Co., Mansfield, Mass.

Iron Planers from 16″ to 36″ wide by any length. H. C. Pease & Co., Worcester, Mass.

R. G. Du Bois, 715 11th St., Washington, D. C. Procures first class patents on inventions. Write.

Universal Vise Chucks. Pedrick & Ayer, Philadelphia, Pa.

Link Planer Attachments. Pedrick & Ayer, Philadelphia, Pa.

For the latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Send $1 for Catalogue D, Fine Tools and Supplies. Over 550 pages. Fully illust'd. Free when $10 worth goods are ordered. Frasse & Co., 92 Park Row, N. Y.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

For Portable Key-seating Machines and Stub Ends for small connections, address T. C. Dill Machine Co., 726 Girard ave., Philadelphia, Pa.

25″ 28″ 32″ 36″ Upright Drills a specialty. Finely made, great capacity, quickly operated, prices low. Send for list of firms using our Drills. J. E. Snyder, Worcester, Mass.

The Holly Manufacturing Company, of Lockport, N. Y., will send, on application, their pamphlet illustrating pumping machinery and reports of duty trials.

25″ 32″ 37″ 42″ "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

Standard Reducing Valve, Standard Pump Pressure Regulators, Improved Collignon Cylinder Oil Pumps, Jenkins Globe and Angle Valves. Send for circulars. Standard Regulator Co., Buffalo, N. Y.

Steam Boilers: Their management and working on land and sea. By Jas. Peattie. Practical facts from 30 years' experience. 230 pages. Illustrated, 12mo., cloth, $2. Circulars and Catalogue of Books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N.Y.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

H. B. Roelker, 22 Cortlandt st., New York, late Sup't De Lamater Iron Works, will hereafter manufacture the De Lamater Screw Propeller.
Propellers of same pattern and workmanship as formerly made by the De Lamater Iron Works. Each designed for its special work at lowest prices.
Consulting Expert and Constructing Engineer.
Estimates made on machinery and on damages.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2. postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including Dec. 5, 1889 issue, 91 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

Just concluded. "Modern Locomotive Construction." By J. G. A. Meyer. The above series of 106 articles, which have attracted so much attention everywhere, is now concluded in newspaper form. Copies of the AMERICAN MACHINIST containing the entire set, sent by mail to any address in the U. S., Canada or Mexico, for $5.30. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton street, New York.

Pratt Institute, Ryerson st., between DeKalb and Willoughby aves., Brooklyn, N. Y.
Second term, day and evening classes in all departments, begin Jan. 2, 1890.
Department of Mechanic Arts.
New evening classes in turning, pattern making and machine shop work.
Also classes in electrical construction—lectures and laboratory work.
Applicants for the above must be at least seventeen years of age.
Afternoon classes in carpentry and forging for boys of fourteen years of age or over.
For application blanks and further information, apply to F. B. Pratt, Secretary.

C. H. De Lamater & Co. have closed their extensive manufactory at the foot of West 13th street, New York, and have sold the Hot Air Pumping Engine and Steam Pump business to the De Lamater Iron Works (incorporated in 1889), and the Propeller Wheel business to the Samuel L. Moore & Sons Co., of Elizabethport, New Jersey.

In order to close out the remainder of the stock, offer for sale a very desirable lot of machinery, such as lathes from 15″ to 88″ swing, planing machines 48″x45″x10′, 59″x50″x12′, 17″x14″x24′, 72″x 69″x24′, and various other sizes; drilling machines, slotting machines, shaping machines, boring machines, bolt-cutting machines, cutting-off machines, nut tappers, milling machines, gear cutters, emery tool grinders, portable drills, screw-cutting machines, vises, lathe and planer tools, and a variety of small tools; also traveling and jib cranes.

Punching and shearing machines for boiler makers, with a general outfit of small tools. Blacksmiths' tools, such as anvils, sledges, tongs, etc. Pattern lathes, benches, saws, screws, nails, and a general supply of small tools. Foundry cranes, cupolas and small tools. Blocks, ropes, bolts, nuts, washers, packings, pipe and fittings, iron and brass valves. Boiler iron, steel plate and boiler rivets. Bar iron and steel, also steam hammers and two 8″x16″ and one 10″x20″ Rider cut-off engines.


## MANUFACTURES

The Chrome Steel Works, Brooklyn, N. Y., are to be enlarged.

W. J. Mack will start a machine shop at St. Augustine, Fla.

The Rogers Foundry and Machine Company, Belleville, Ill., will increase their plant.

The Eufaula (Ala.) Cotton Mills will double the capital stock and enlarge the works.

An oil mill, an ice factory and a cold storage plant will be built at Brenham, Texas.

T. W. Dexter is organizing a company to establish a foundry and machine shop at Brunswick, Ga.

C. C. Gibson & Sons will rebuild their saw-mill and planing-mill recently burned at Magnolia, Miss.

The Colby Testing Machine Manufacturing Co. has been incorporated at Chicago, Ill. Capital, $100,000.

O. Whitney & Co., Ashburnham, Mass., are building a chair factory, 50x128 feet, and a boiler and engine-room.

The citizens of Saccarappa, Maine, are taking measures to establish a stock company to build a shoe factory.

The rolling mill of the Stewart Iron Co., at Sharon, Pa., has been started up, after more than a year's idleness.

The Gonzales (Tex.) Water Power Co. has been organized, to build a dam on the Guadalupe river, and furnish water-power.

The Royal Electric Company is the name of a new company that proposes to manufacture electrical apparatus at Peoria, Ill.

Articles of incorporation have been granted to the Dodson Safety Nut Lock Company, to manufacture nut locks for railroad use, at St. Louis, Mo.

The Spiral Weld Tube Co., of East Orange, N. J., intends to double its mill capacity. It has under contract machines which will turn out 7,150 feet per day.

Forbes & McCrary, of Atlanta, Ga., are organizing a $500,000 stock company to erect a large cotton mill at Greenville, Miss. $250,000 of the stock has thus far been subscribed.

Bemis & Dustin, of Chicago, Ill., offer to erect a woolen and worsted mill and knitting factory at Cumberland, Md., if the citizens donate a site and subscribe for $125,000 of stock.

The Billings & Spencer Co., Hartford, Conn., recently received an order from the Edison Machine Works for 60,000 commutator bars, requiring 30 tons of copper to make.

The Canadian Bridge and Iron Company has been incorporated at Montreal, with a capital stock of $75,000, for the construction of iron bridges and the manufacture of iron work generally.

There is water-works agitation at Oxford, Miss.; Colville, Wash.; Derry, N. H.; Waycross, Ga.; Albany, Ga.; Needham, Mass.; Boise City, Idaho; Minden, Ill.; Hillsborough Bridge, N. H.; Benton Harbor, Mich.

The Fulton Iron and Engine Works, Detroit, Mich., have issued a small circular, illustrating the new steel tackle block they are putting on the market. Several high testimonials in favor of the block are published.

The Dexter Spring Company's works at Verona Pa., have been purchased by a stock company. Articles of incorporation have been applied for by Geo. B. Knox and others. The company will manufacture the Dexter buggy spring, and add other specialties in the future.

The capital stock of the Gate City Iron Works, Winona, Minn., has been increased to $200,000. Twenty thousand dollars of the stock is preferred, and entitles the holder to receive annual dividends up to ten per cent. before the holders of common stock receive anything.

The Campbell & Zell Mfg. Co. has, it is stated, purchased the Baltimore (Md.) Car Wheel Co.'s old foundry and machine shop. The foundry is 160x80 feet, and the machine shop three stories, 60x60 feet. The company has a capital stock of $100,000. J. Vernon Campbell is president.

It is proposed to erect a jute mill for the manufacture of jute bagging, in the new State of Washington. The mill will be conducted by the State, for the purpose of giving employment to the convicts. The legislature will be asked to appropriate $50,000 for this purpose.

The new addition to the works of the Pittsburgh (Pa.) Steel Casting Company will include a Bessemer plant in connection with their foundry, enabling them to make castings up to eight tons weight. An eight-ton converter will be built. The plant will be in operation early in the spring.

S. W. Goodyear, Waterbury, Conn., sends us a sheet illustrative of the wire-pointing machinery made by him. This is a cold-compression process and the operation is performed with great rapidity. The process is valuable in the production of many forms, and for pointing wire for wire-drawing Mr. Goodyear's machines are in high repute.

At a recent meeting of the New England capitalists interested in the matter, nearly $200,000 was subscribed to the stock of the Denison (Tex.) Cotton Manufacturing Co., to complete the capital of $500,000, which is required to build and complete the mill. Among the directors of the company already selected are Col. Elias Miliken, of Maine, and Hon. Francis Jewett, of Massachusetts.

The works of the Straight Fiber Iron Co., of Chicago, were completely destroyed by fire about one year ago. They have lately been rebuilt and greatly enlarged. Iron buildings have been substituted for wooden buildings, new machinery has been added, and the company re-organized and re-officered. The plant, as now equipped, is modern and complete. The specialties are high-grade merchant iron and the "straight fiber car axles." The works are located at 40th street and Stewart avenue, and their capacity is 100 tons of bar iron per day. One hundred men are employed. The present officers of the company are: J. McGregor Adams, president; Walter L. Lee, vice-president and manager; D. P. Donelson, treasurer; F. Newell, secretary; and M. C. Williams, superintendent. The office of the company is 769 The Rookery.—*Railway Review.*

A press dispatch says that the recently organized Southern Iron Company has decided to invest several million dollars in the manufacture of steel in Nashville, and will, on the first of January next, begin the construction, at Chattanooga, of two large open-hearth furnaces, which will make in the aggregate 70 or 80 tons of steel per day. These will be in connection with the steel rail mill which the company owns at that place. The ores owned by the company are claimed to be practically equal to Bessemer, which it expects to convert into Bessemer steel rails, and, if so, to use both the Bessemer and the basic processes. For the present the basic open-hearth method of making steel will be used. Other methods will be adopted if deemed practicable. In addition to the steel industry, the Southern Iron Company is said to contemplate the construction of tin plate mills at Chattanooga.

A Collegeville (Pa.) dispatch says: A bright machinist, Claus H. Van Haagan, employed for four years in this town, has just accepted an offer of $90,000 from the Chester Twist Drill and Tool Company, for an invention for making forge twist drills by machinery. By means of Van Haagan's invention the steel is forged much more rapidly and thoroughly, with a saving of one-third in the raw material, and the product is pronounced to be of much finer quality than any manufactured after the old method. Van Haagan is fifty years old, and is a native of Germany. He came to America in 1859, and, after working at his trade (machinist) in Philadelphia, he grew discontented, and began roving about the country. Four years ago he came to Collegeville. For thirteen years, while drifting from one place to another as a poor journeyman, he spent all his leisure hours upon his invention, adding improvements to it, and bringing it as near to a state of perfection as possible.

The latest issue of the *Age of Steel* has the following in reference to the establishment of steel works in Kentucky: "In our editorial columns reference is made to the establishment of a basic steel plant at Middlesborough, Ky. Contracts have also been placed with Pittsburgh parties for the erection of two large modern blast furnaces at Middlesborough. The equipment of these furnaces will include eight 20x60-foot Whitwell hot blast stoves, six blowing engines, steam cylinders, 42 inches; blast, 84 inches, and stroke 60 inches; twenty-eight steel boilers, each 24 feet long, 54 inches in diameter, and having two 18-inch flues; a wrought-iron, brick-lined draught-stack, 12x180 feet high. The tankage will be a wrought-iron stand pipe, 20 feet in diameter and 75 feet high, and the wrought-iron hoist towers will be equipped with the latest improved engines. The pumps, heaters, steam and water fittings will be of the most modern designs. The buildings will include three casting houses, each of 60 feet span, connected, 150 feet long and 25 feet high; two boiler houses, 50 feet span by 100 feet long; stock house, engine and pump house, and a complete arc light electric plant."

## Machinists' Supplies and Iron.

NEW YORK, Dec. 20, 1889.

Iron—American Pig.—No prices have as yet been fixed for 1890, though orders are being placed subject to the new scale when announced. Prices will depend a good deal on what the Western demand for Southern iron amounts to, as, if this demand is heavy, the Lehigh product will be practically without competition. Those who buy iron for immediate delivery are paying for 1 X foundry, $19 to $19.50, and for special brands as high as $20.50. No. 2 we quote at $18 to $18 50.

Scotch Pig.—The demand is quite limited, and it seems evident that its use will continue to decline in this country, owing to the increased use of Western and Southern irons as softener instead. The best brands are quoted at $26.50 to $27.50; other brands range from $24 to $24.50.

## *WANTED*

*"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.*

Wanted—Position by a mech. engineer with 10 yrs exp. in designing modern mach'y. BOX 60, AM. MACH

Wanted—A competent bobbin and shuttle tool maker. Durham Bobbin & Shuttle Co., Durham, N C.

Wanted—Position as Buyer, Ass't Superintendent or similar place. Best refs. BOX 63, AM. MACHINIST.

Foreman and contractor wanted, who can handle men and do good work promptly. Address Steam Engine, care AMERICAN MACHINIST.

Wanted—Foreman boiler works who can manage about 25 men and get out good work at lowest cost. Address A. J. P., AMERICAN MACHINIST.

Wanted—Good agents to sell on commission the Combination Pump and Heater. See ad. with cut of the machine. D. E. Rice, Detroit, Mich.

Wanted—A first-class foreman for foundry. Steady employment. State exp. and salary. Also one pattern maker. D. J. Murray Mfg. Co., Wausaw, Wis.

A thorough machinist and tool maker, having held position as foreman, will be open for engagement after 1st Jan. Address Box 61, AMERICAN MACHINIST.

Machinists Wanted—Vise hands accustomed to first-class work. Steady employm't and liberal wages guaranteed. Have largely increased our plant and need more men. Niles Tool Works, Hamilton, O.

Wanted—Mechanical engineer as sup't in shops doing engine, boiler and foundry business. To the right party, having a little money to invest, an interest would be given. Address B., care AM. MACH

Wanted—A first class draftsman; one who has had shop experience preferred. Address J. H. Mc Ewen & Co., Manufacturers of Engines, Saw-mill and Tanning Machinery, Ridgway, Pa.

Wanted—Capable mech. draftsman who has had practical shop experience. Address "Bellamy," AMERICAN MACHINIST, stating extent and kind of experience had, and compensation looked for.

Wanted—Foreman moulder, must understand general work and the mixing of iron; also one foreman pattern maker, accustomed to general work and handling men. Good wages and permanent place. Apply, giving refs, to BOX 62, AM. MACH.

Wanted—A first-class mechanical draftsman, familiar with modern blast furnace work. Must be able to come on at once. Address, with full particulars, West Superior Iron and Steel Company, West Superior, Wis.

Wanted—As bookkeeper and stock clerk in a machine works, a capable and energetic young man who has some knowledge of such business. Address, stating fully exp., refs., age, and salary wanted, E. H. Cutler, 80 Decatur st., Brooklyn, N. Y.

Wanted—Superintendent for pipe mill. The applicant must be thoroughly acquainted with all the details of the pipe business, must be able to construct and run either Bell, Butt or Lap-Weld Furnaces. Must understand the use of natural gas as fuel, and all that pertains to Siemens Furnaces. Apply to Oil City Tube Co., Oil City, Pa.

## ✣ MISCELLANEOUS WANTS ✣

*Advertisements will be inserted under this head at 35 cents per line, each insertion.*

¾" Portable Drill, $100. Am. Tool W'k's., Clev. O.

Koopman's Scales for quick measurements.

Glass Triangles. F. E. Harthan, Worcester, Mass.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, O.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

August C. Christensen, 24 State st., N. Y., Consulting Engineer. Designs of all kinds of Machinery.

Turned and Highly Polished Iron and Steel Shafting a specialty. Merwin McKaig, Cumberland, Md.

Complete list of our Scales and other new tools for 2c. stamp. A. T. Koopman, Chicago.

Wanted—Patents of merit to manufacture and introduce. Box 46, AMERICAN MACHINIST.

Wanted—A 2nd-hand steam hammer, 500 to 700 lbs. Address Hammer, AMERICAN MACHINIST.

For Sale Cheap—8 H. P. Clerk gas engine; little used; in good order. C. S. Brown, Superintendent, Terre Haute, Ind.

Wanted—To buy the good will and fixtures of a medium-sized machinery business situated in a good town or city. Address V. P., AMERICAN MACHINIST.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Wanted—More heavy and light machine work, also manufacturing, by well-equipped machine shop. Address Box 1,446, New Haven, Conn.

For Sale—An established mach. business, protected by valuable patents. Can be much enlarged by judicious management. C. M. W., AM. MACHINIST.

Wanted—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

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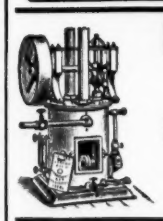
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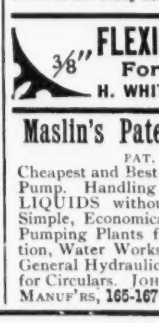
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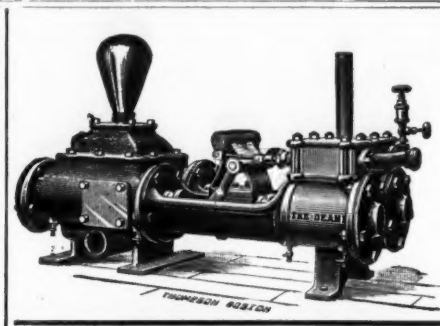
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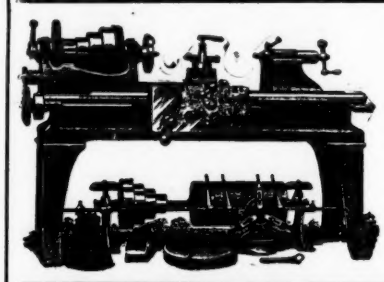
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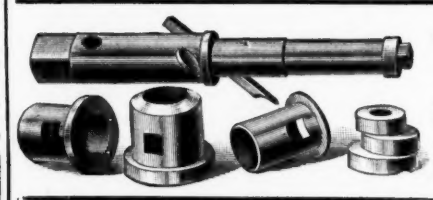
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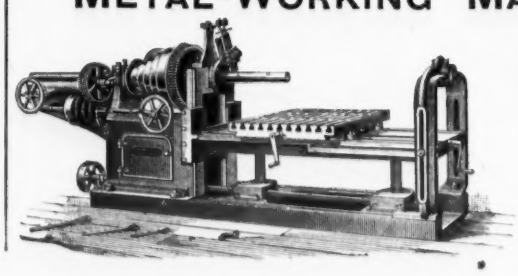

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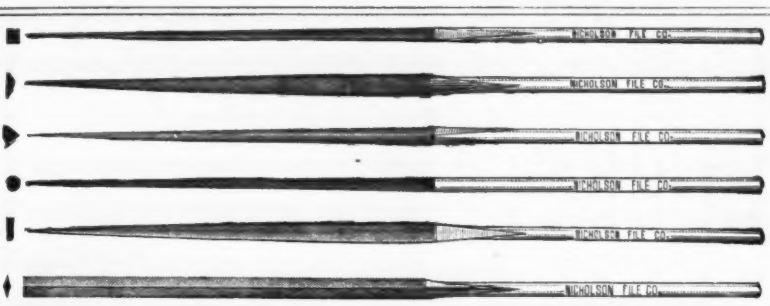


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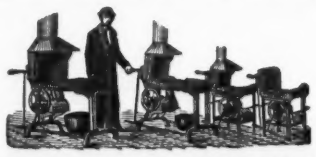

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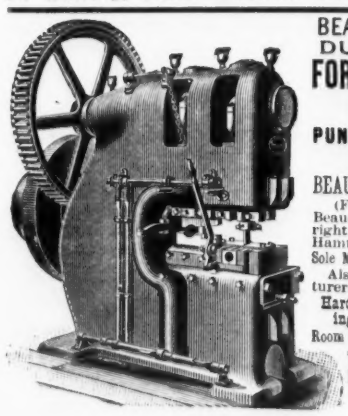

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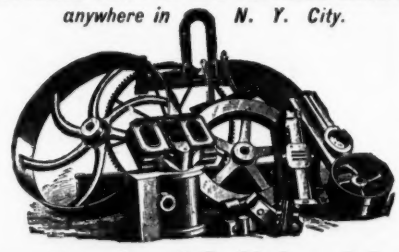

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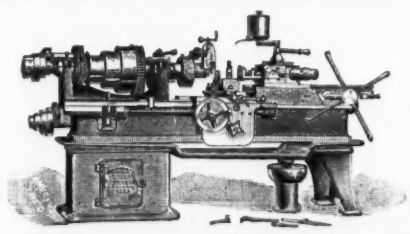

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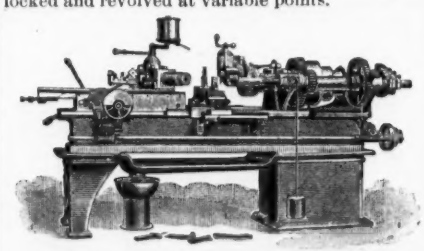

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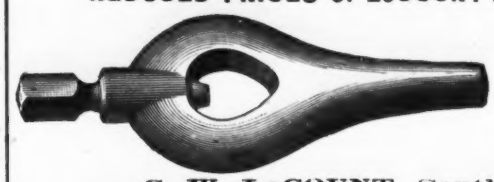

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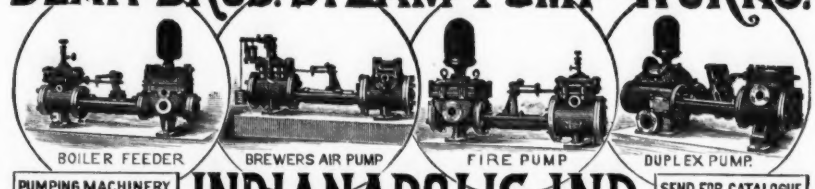


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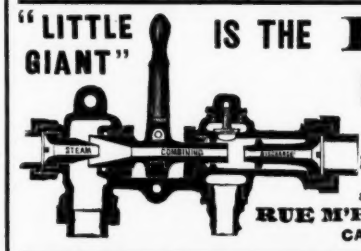


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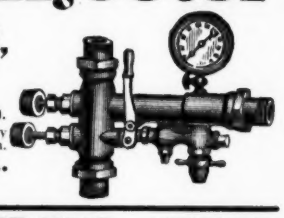

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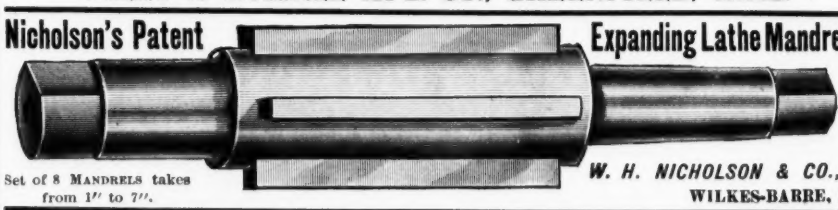

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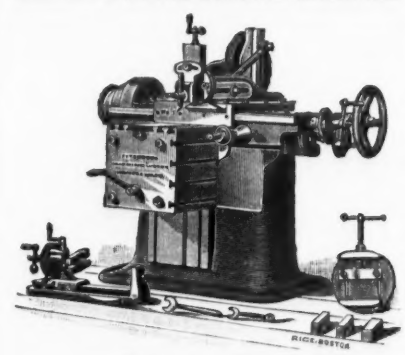


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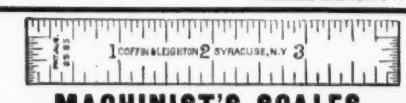


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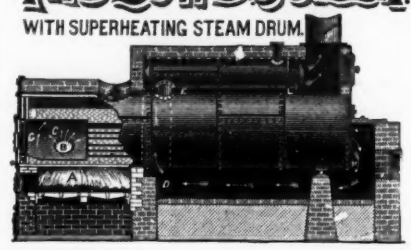

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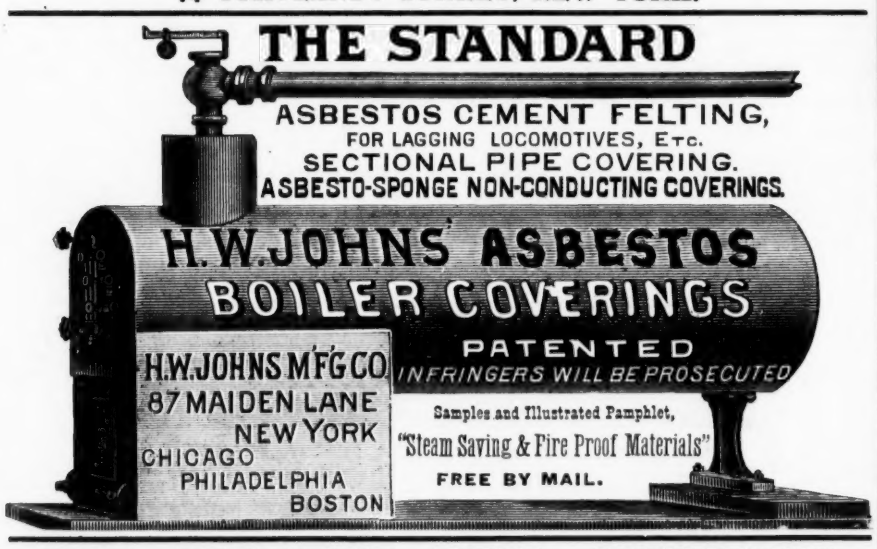


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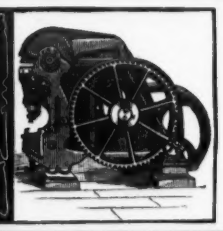

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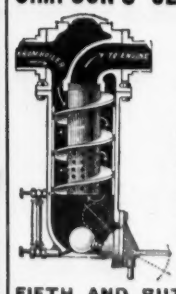

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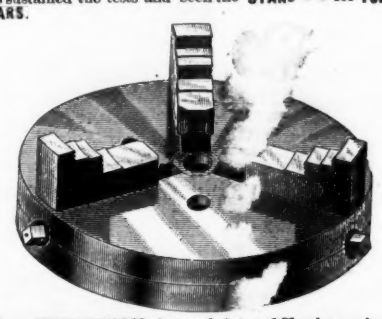

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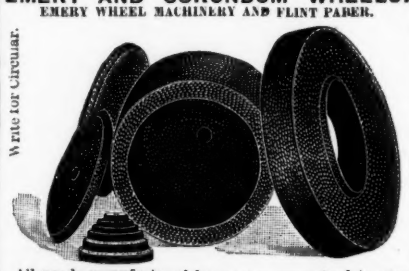

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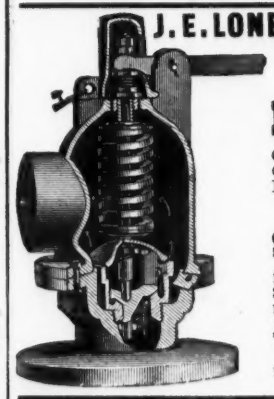

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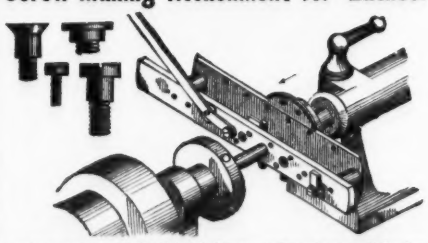

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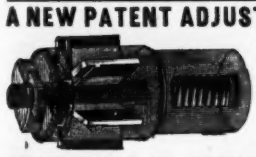

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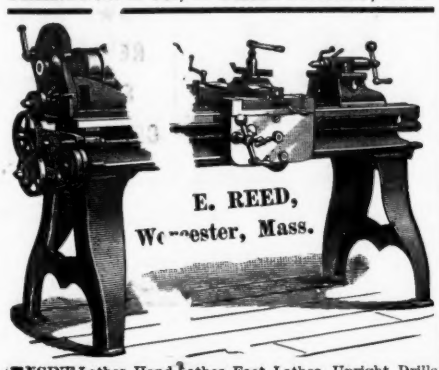

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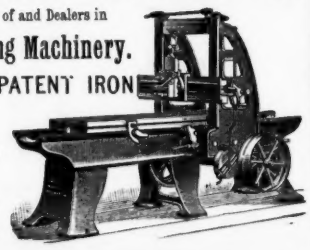

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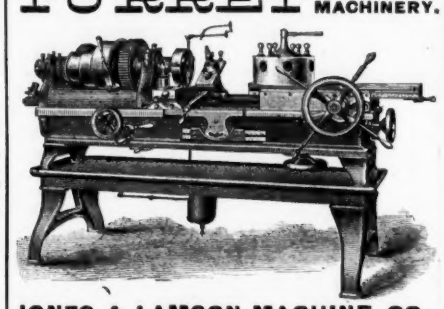

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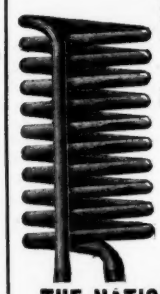

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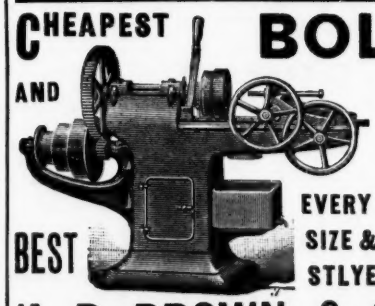

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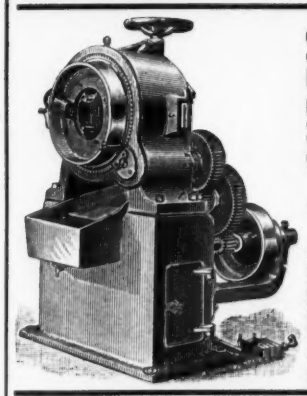

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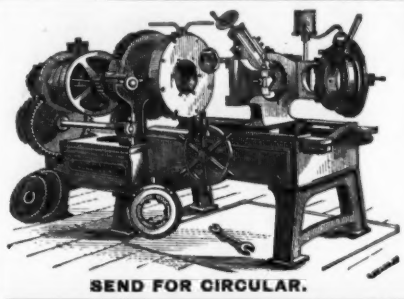

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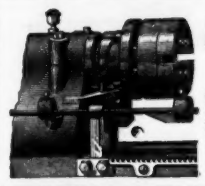

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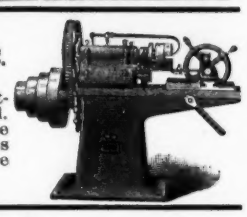

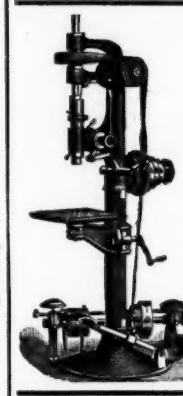

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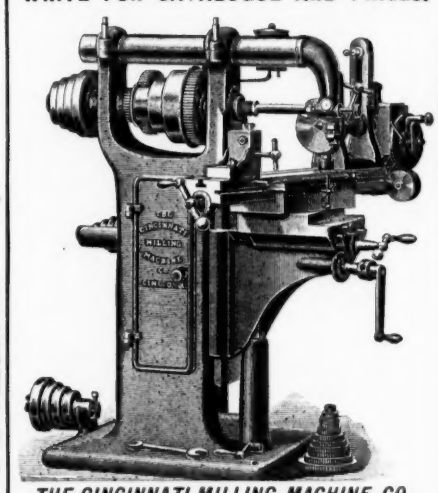

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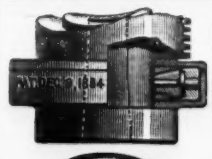

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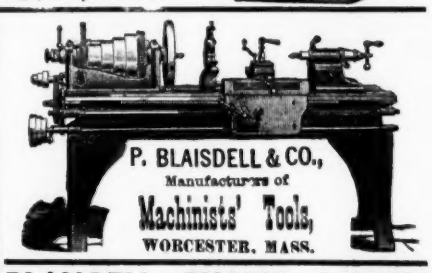

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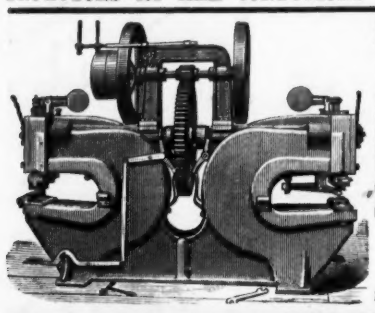

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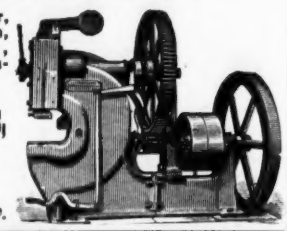

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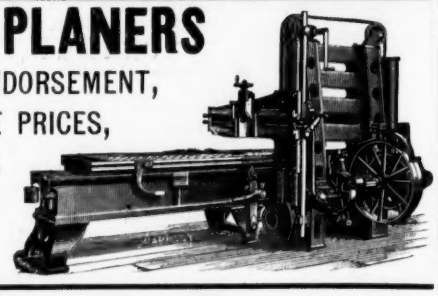

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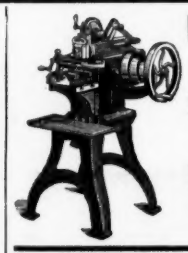

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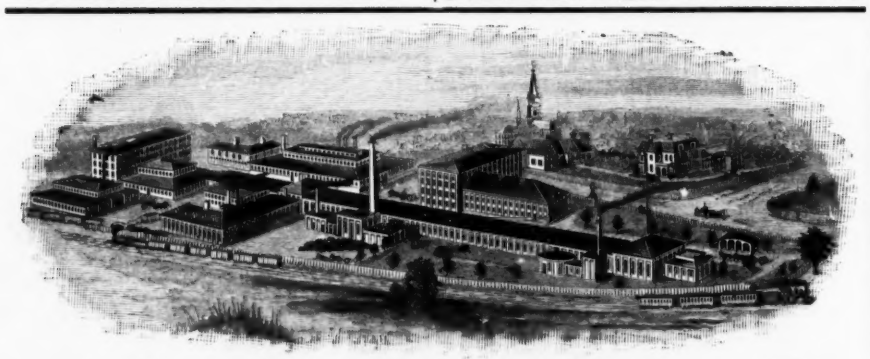

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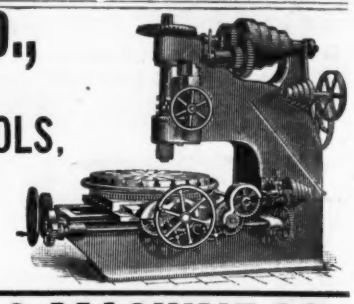

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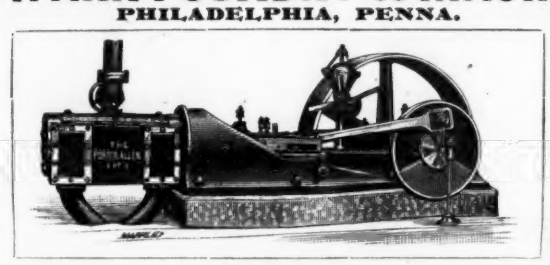

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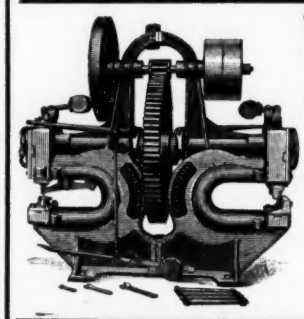

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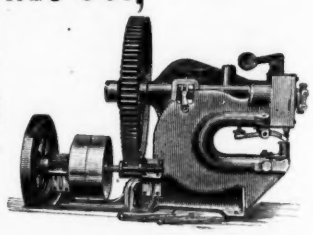

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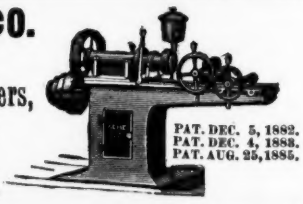

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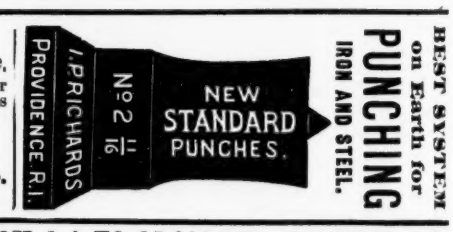


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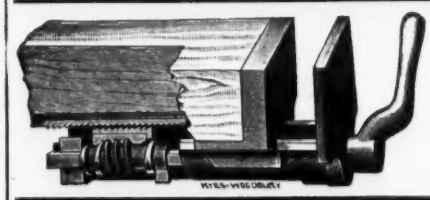

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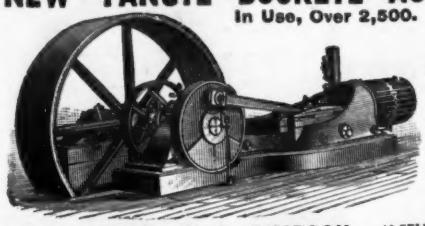

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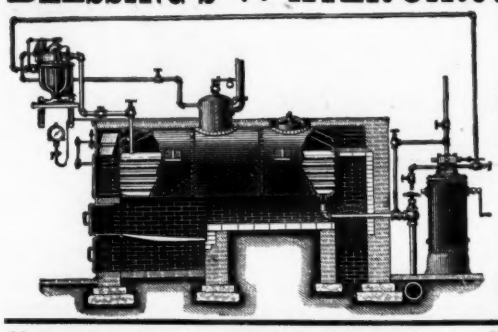

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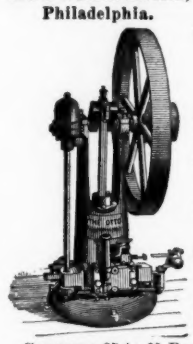

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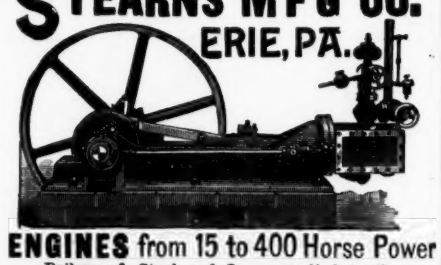

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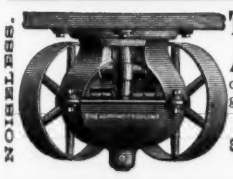

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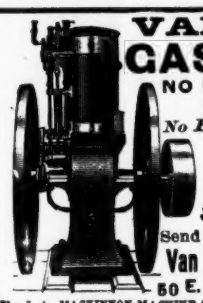

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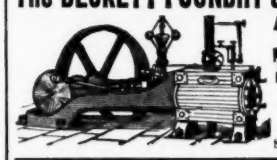

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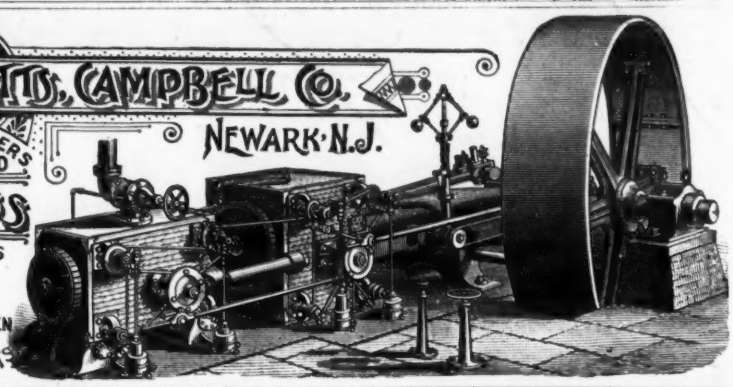

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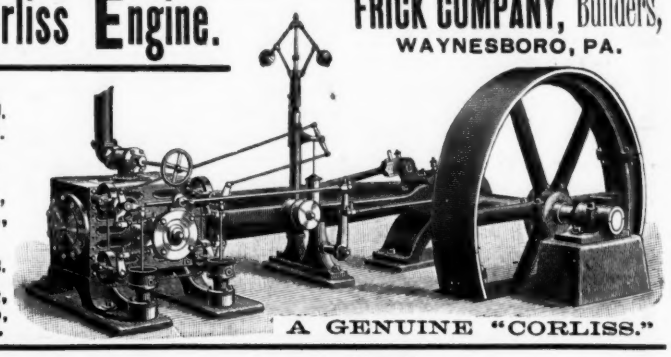

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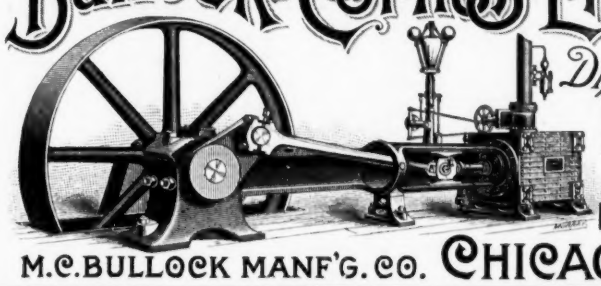

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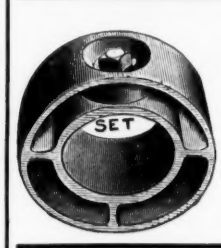

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SET SCREWS PROTECTED.

NO BOLTS USED.

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MADE STRONG, LIGHT AND NEAT,

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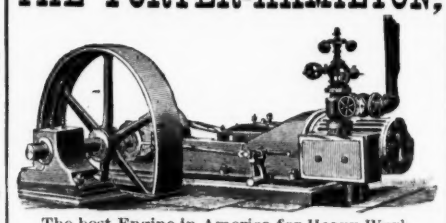

The best Engine in America for Heavy Work.

**WILLIAM TOD & CO.,**

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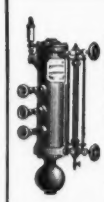

Investigate the merits of the Reliance Safety Water Columns. It pays to keep posted. Many of the largest corporations have found it profitable to discard the old appliances, and adopt these safeguards. There is always economy in safety. Send for illustrated price-list.

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**DUPLEX PUMPS** ALL SIZES. EVERY SERVICE

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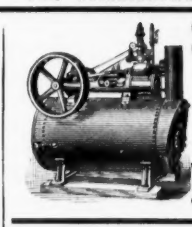

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Upright and Horizontal, Stationary, Portable and Semi-Portable.

3 to 16 Horse Power.

Illustrated Pamphlet Free. Address

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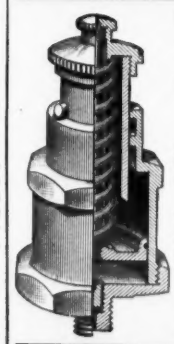

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Will Save its Cost in Oil alone Several Times per Annum.

SAVES ALSO IN LABOR, AND COST OF COTTON-WASTE. PREVENTS DRIPPING AND SPATTERING.

A POSITIVE FORCE FEED with the most PERFECT REGULATION and GREATEST CONVENIENCE in operation yet attained in any device for the lubrication of machinery. Works equally well in every possible position.

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For Separating and Removing Entrained Water from Live Steam;

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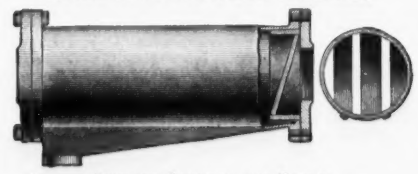
SPECIAL DESIGNS FOR SURFACE CONDENSERS.



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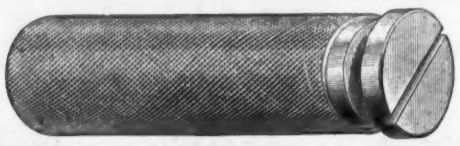

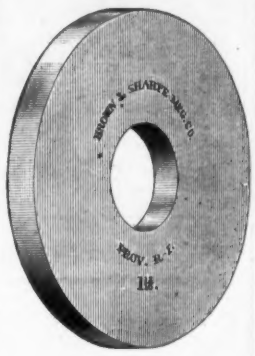


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**For use in Setting Calipers, Testing Measuring Tools, and Reference for Sizes in Shop Practice.**

They are made of steel, hardened and accurately ground to size.
Price of complete set (45 disks and 6 handles), $35.
Single disks from 60 cts. to $1.50. Single handles from 45 to 60 cts.

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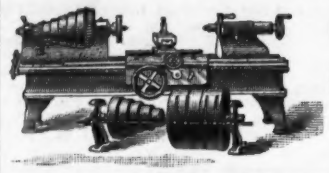

Manufacture **LATHES** of Various Sizes

AND OF THE FOLLOWING KINDS:

**Hand, Engine for Turning and Screw Cutting, Cutting Off, Gap Bed, Pulley Turning and Boring, Turret-Head Engine and Chucking, Hand Wheel Rim Turning, Spinning, Grinding, Pattern Making, &c.**

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*FURNISHED IN TWO SIZES, EITHER SIZE WITH BENT OR STRAIGHT HOLDER.*

WE FURNISH CUTTERS FOR U. S. S. THREADS TO FIT THESE TOOLS.

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**DROP FORGINGS OF BRONZE, COPPER, IRON & STEEL OF ALL DESCRIPTIONS.**

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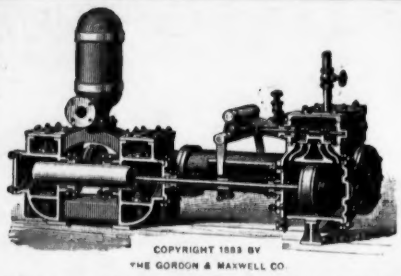


# THE GORDON STEAM PUMP CO.

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**BRANCH HOUSES:**
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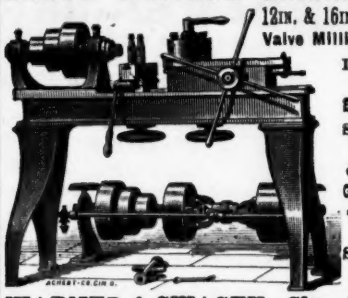

12IN. & 16IN. MONITORS.
Valve Milling Mach's
Double Key Lathes,
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Revolving Chucks for Globe Valves,
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Formerly of Worcester, Mass.

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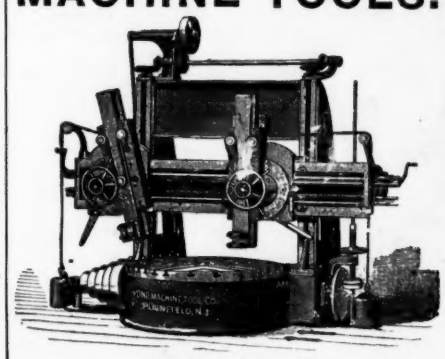

**BORING MILLS.**

Radial Drills, Planers, Lathes, Heavy & Powerful, from new patterns of the latest and best designs.

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## The Original Unvulcanized Packing

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Accept no packing as JENKINS PACKING unless stamped with our "Trade Mark."

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FROM 16 to 48 IN. SWING.

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Attending the sale of our **IMPROVED MACHINE TOOLS** in the East has decided us to open, January 1st, 1890, a

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**Under the management of W. H. HARRISON, late with E. P. BULLARD.**

WE WILL CARRY A FULL LINE OF NEW DESIGNS OF

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**Come and see us before buying.**

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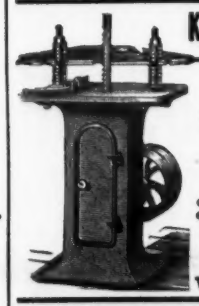

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**Lathes, Planers, Drills,** or anything in Machinists' Tools or Supplies.

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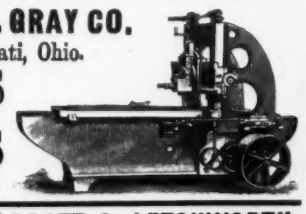

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## EBERHARDTS PATENT DRILL PRESS.

The only one built on **correct principles.**
More **economical** than any we have ever used.
Can do **double** the work. Most convenient.
**Best** in the market. Much admired.
No trouble or expense for repairs.
Could not ask for anything better.
There may be as good a one made by some one else, but **I have not seen it.**
I feel that I **did wisely** in buying your tool.
We consider it a **model tool** and fills the whole bill.

Below we give the names of a few who are using our Pat. Drills, Gear Cutters, Shapers, etc. Machines.

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| Worthington Pump Works, Brooklyn, N. Y. | 8 |
| King Iron Bridge Works, Cleveland, O | 9 |
| Filer & Stowell Mfg. Co., Milwaukee, Wis | 3 |
| Hutchinson, Hollingsworth & Co., England | 8 |
| Daft Electric Light Co., Marion, N. J | 3 |
| Pratt & Whitney Co., Hartford, Conn | 8 |
| R. Hoe & Co., New York City | 11 |
| Cooke Locomotive Works, Paterson, N. J. | 9 |

Also, Standard Oil Co., Lima, O.; Morgan Engineering Co., Alliance, O.; Grand Trunk Railway of Canada, Montreal, Can.; Brainard Milling Machine Co., Hyde Park, Mass.; Boston Bridge Works, Boston, Mass.; Pond Machine Tool Co., Plainfield, N. J.; Niles Tool Wks., Hamilton, O.; Geo. A. Gray Co., Cincinnati, O. Write to

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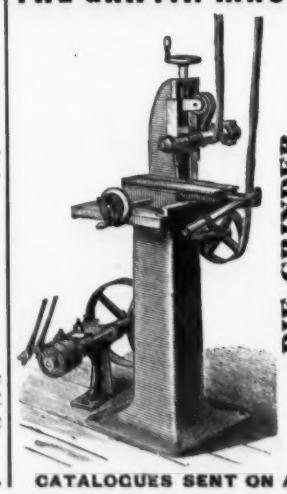
**For Catalogue A. NEWARK, N. J.**

# THE GARVIN MACHINE CO.



**DIE GRINDER.**

This is a very desirable and handy tool, designed particularly for use in connection with punch presses for grinding and sharpening dies, punches, etc.

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CATALOGUES SENT ON APPLICATION.

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24" Pillar Shaper.

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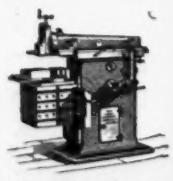

25" Pillar Shaper.

THE HENDEY MACHINE CO.
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MANUFACTURERS OF
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SEND FOR OUR CATALOGUE.

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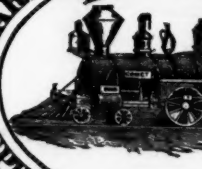

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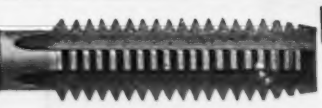

Manufacturer —of— TAPS & DIES


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